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TURNKEY EXPERIENCE IN AMERICAN PUBLIC TRANSIT

A STATUS REPORT



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16. Abstract <p>This is an Interim Status Report to Congress. It was prepared as part of the oversight function of the FTA Turnkey Demonstration Program. The study is intended to inform Congress on issues of national importance, lessons learned, and outstanding issues of this Turnkey Demonstration Program to date. Basically, the turnkey method is defined --"an innovative procurement technique in which a public entity contracts with a single private entity to deliver a complete and operational product, such as a fixed-guideway system or extension of an existing system." This Status Report provides Congress with an update on the progress being made in implementing the Turnkey Demonstration Program. The report is divided into five chapters. Chapter 1 introduces turnkey and describes FTA's Turnkey Demonstration Program. Chapter 2 provides a summary of the programs's growth and challenges to its application in transit. Chapter 3 identifies key variables common to the five projects in the FTA Demonstration Program, including project definition, experience, cost, contracts, operation and maintenance, financing, land acquisition, technology and site control. Each variable is described in relation to the five projects. Chapter 4 summarizes the lessons learned in 14 key areas. Chapter 5 provides a conclusion. A summary of tunkey benefits is provided along with major regulatory and instituional changes turnkey requires.</p>				
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**Turnkey Experience in American Public Transit:
A Status Report**

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PREFACE

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) includes goals to foster advanced technologies and the introduction of delivery mechanisms that decrease the developmental costs of new transit systems. Congress included the provisions for the Federal Transit Administration (FTA) Turnkey Demonstration Program in Section 3019 of ISTEA. The Turnkey method is defined as “an innovative procurement technique in which a public entity contracts with a single private entity to deliver a complete and operational product, such as a fixed guideway system or extension of an existing system.” ISTEA authorized the FTA to select two or more transit projects that would participate in the Turnkey Demonstration Program. The projects selected are: Baltimore Phase II Central Light Rail Line, Los Angeles Union Station Gateway, San Francisco Bay Area Rapid Transit Airport Extension, New Jersey Transit Hudson-Bergen Light Rail, and San Juan, Puerto Rico Tren Urbano.

The FTA is responsible through Section 3019 to report to Congress on the progress of the demonstration program, the identification of the associated turnkey guideline modifications and the results of the comparative cost and schedule differences between the conventional and turnkey projects. Although this report was prepared prior to passage of the Transportation Equity Act for the 21st Century (TEA-21), Section 3023 of TEA-21 affirms and strengthens FTA's commitment to turnkey project delivery. Several turnkey workshops were held to assist FTA in meeting this legislative requirement. The topics reported on include: Engineering, Procurement, Financing, Environmental Issues, Quality Assurance/Quality Control and Value Engineering, Risk, and Project Control.

This is an Interim Report to Congress and was prepared as part of the oversight function of the FTA Turnkey Demonstration Program. It is intended to inform Congress on issues of national importance, lessons learned, and outstanding issues of this Turnkey Demonstration Program to date. The FTA Office of Research, Demonstration and Innovation (TRI) provides the overall program direction and management of the Turnkey Demonstration Program. This report was prepared by the U.S. Department of Transportation John A. Volpe National Transportation Systems Center under the supervision of Terrence M. Sheehan, with principal assistance from Jeffrey A. Parker (Jeffrey A. Parker & Associates), as well as Thomas J. Luglio, Jr. (EG&G/Dynatrend and Planners Collaborative, Inc.), Donald Schneck (Booz-Allen & Hamilton, Inc.), Joel Washington (Joel Washington & Co.), and Bedros Enfiedjian (Gardner Consulting Planners) under the guidance and critical review of Edward L. Thomas, Associate Administrator for TRI, and Mary L. Anderson of TRI.

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LIST OF ACRONYMS AND ABBREVIATIONS USED IN THIS REPORT

A/E	Architect/Engineer
AGT	Automated Guideway Transit
ASC	Alignment Section Contracts
ASCE	American Society of Civil Engineers
ACEC	American Consulting Engineers Council
APWA	American Public Works Association
BART	Bay Area Rapid Transit District
BAFO	Best and Final Offer
BCA	Benefit Cost Analysis
BOT	Build-Operate-Transfer
BOOT	Build-Own-Operate-Transfer
BWI	Baltimore/Washington International Airport
CAPRA	Capital Reserve Account
COMAR	Code of Maryland Regulations
CPM	Critical Path Method
DBE	Disadvantaged Business Enterprise
DBIA	Design Build Institute of America
DBOM	Design-Build-Operate-Maintain
DRB	Dispute Resolution Board
DSD	Division of State Documents (Maryland)
FARS	Federal Acquisition Regulation System
FMO	Financial Management Oversight
FMOC	Financial Management Oversight Consultant
FDOT	Florida Department of Transportation
FFGA	Full Funding Grant Agreement
GEC	General Engineering Consultant
GMAEC	General Management and Architectural and Engineering Consultant
GMC	General Management Consultant
IOS	Initial Operating System
IRS	Internal Revenue Service
LACMTA	Los Angeles County Metropolitan Transportation Authority
MTA	Maryland Mass Transportation Administration

MDOT	Maryland Department of Transportation
MBE	Minority Business Enterprise
PMO	Project Management Oversight
PMOC	Project Management Oversight Consultant
PRHTA	Puerto Rico Highway and Transportation Authority
PRDTPW	Puerto Rico Department of Transportation and Public Works
QA/QC	Quality Assurance/Quality Control
ROW	Right-of-Way
STTT	Systems and Test Track Turnkey
TRB	Transportation Research Board
TUO	Tren Urbano Project Office
UDOT	Utah Department of Transportation
VE	Value Engineering
VNTSC	John A. Volpe National Transportation Systems Center

EXECUTIVE SUMMARY

The transportation industry is taking notice of the benefits of the turnkey method to infrastructure project delivery as reflected in the growth of its use and of industry dialogue since enactment of ISTEA. The changing direction of mass transit project delivery practices is being stimulated by five demonstration projects FTA is sponsoring under ISTEA's Turnkey Demonstration Program (Section 3019). These projects emerged from a comprehensive industry review process that triggered 17 requests for designation. The legislation required that FTA approve no fewer than two projects to demonstrate turnkey procurement practices in an effort to "advance new technologies and lower the cost of constructing new transit systems."

A turnkey system undertaking was defined by Congress as "a project under which a recipient contracts with a consortium of firms, individual firms, or a vendor to build a transit system that meets specific performance criteria and which is operated by the vendor for a period of time." Congress also permitted contract awards for turnkey-type procurements be made to other than the lowest bidder when such an award leads to reduced long-term costs.

This Status Report provides Congress with an update on the progress being made in implementing the Turnkey Demonstration Program. Some of the underlying benefits of the turnkey method include:

- expedited procurement,
- improved risk allocation,
- encouraged applications of new technology,
- promoted accountability through a single point of contact,
- accelerated schedules for project delivery,
- reduced costly change orders,
- facilitated partnering,
- strengthened program management,
- facilitated opportunities for innovative finance, and
- secured bids based upon factors other than lowest price.

This report is divided into five chapters. Chapter One introduces turnkey and describes the FTA Demonstration Program. Chapter Two provides a summary of the growth of Turnkey and challenges to its use in transit applications. Chapter Three provides detailed information on the factors affecting turnkey initiatives in public transit. Chapter Four details lessons learned from the demonstration projects and identifies outstanding issues. Chapter Five is the conclusion.

Chapter One provides information about turnkey in a historical context. This chapter also provides a description of the legislative and regulatory actions taken to advance turnkey. The projects currently underway are summarized and the turnkey method is described in relation to the FTA development process. This section also includes a glossary of turnkey terms. The FTA turnkey program has been developed with significant industry outreach, which is summarized in this chapter. The section also describes oversight and evaluation of the demonstration projects.

Interest in turnkey has grown rapidly. This growth, and the increased consideration of turnkey by the transportation industry, is described in Chapter Two. One indication of this growth is the interest in turnkey from professional and industry publications and examples are included in this chapter. This growth has also required changes in law and regulation at the Federal, state, and local levels. Some of

these changes are described in this chapter. This section provides a description of early use of turnkey components by the highway industry and the transit industry's early experience with turnkey. These experiences provide information on regulatory and institutional barriers to turnkey. Regulatory issues affect turnkey at all levels of government. Only 21 states have legislative authority for turnkey. Of these, ten allow for full implementation of a turnkey project. This section provides information on the legislative and regulatory issues faced in each of the three states, plus Puerto Rico, that are implementing demonstration projects.

Chapter Three identifies the key variables common to the five projects included in the FTA Demonstration Program. These variables are:

- Project Definition,
- Complexity,
- Experience,
- Cost,
- Contracts,
- Operation and Maintenance,
- Financing,
- Land Acquisition,
- Technology, and
- Site Control.

Each of these variables are described as they relate to all five projects. In some cases, the effect of a variable on one project differs significantly from another project. For example, four of the five sites are rated high for experience. This is because four of the five sites currently operate fixed rail systems similar to the projects being built under turnkey. One, Puerto Rico, is rated as low because the transit agency has no experience developing or operating a fixed rail transit system.

Chapter Four summarizes lessons learned in 14 key areas. These areas are:

- Procurement Strategy and Contracts,
- Project Management and Control,
- Disadvantaged Business Enterprises,
- Quality Assurance/Quality Control,
- Risk Management,
- Liquidated Damage Provisions, Claims, and Change Orders,
- Time Savings,
- Industry Investment and Contract Reviews,
- Value Engineering,
- Dispute Resolution Practices,
- Cost Control,

- Schedule Management,
- Introduction of New Technology, and
- Operations and Maintenance.

This chapter describes each of these key areas. In most cases, these key areas are then described in some detail, with experiences from the demonstration projects presented. In some cases, these experiences identify comparable issues in different projects. In other cases, examples show the variety of options available using turnkey. This chapter demonstrates both the complexities and opportunities offered by turnkey.

Chapter Five provides a conclusion to the Report. A summary of the benefits of turnkey is provided, as are the major regulatory and institutional change turnkey requires. The conclusion provides a summary of the status of the five demonstration projects and notes that the industry's interest in and understanding of turnkey is growing rapidly.

1.0 FEDERAL TRANSIT ADMINISTRATION TURNKEY DEMONSTRATION PROGRAM

This report documents preliminary observations from the Turnkey Demonstration Program being conducted by the Federal Transit Administration (FTA). Through Section 3019 of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), FTA is responsible to report on the results of the demonstration effort, identify FTA grant and project management procedural guideline modifications, and assess cost, schedule, new or advanced technology introduction and other differences between conventional and turnkey projects. The following chapters review:

- Background of the Turnkey Demonstration Program
- The status of each Turnkey Demonstration Project
- Methods used for project delivery
- Lesson's Learned and Outstanding issues.

Major issues discussed relate to Engineering/Design, Procurement Project Management, Construction/Systems Installation, Operations & Maintenance and, Ownership Transfer.

1.1 *Historical Context*

Up until 200 years ago it was common for one entity to be contracted to design and construct a complete facility. As early as 1800 BC, "Master Builders" were commissioned by kings to build palaces. Over time, economic philosophies, proliferating regulations, engineering design complexity, functional specialization, and legal issues established "design-bid-build" as the "conventional" method for developing fixed guideway public transport systems. The conventional method has the benefit of providing numerous safeguards against potential abuse, but at the cost of slower, more expensive, and less innovative project delivery.

In advancing a multi-billion dollar annual capital grant program for transit infrastructure, FTA faces funding demands far in excess of available resources. During the 1980's FTA launched numerous research and technical assistance initiatives to improve the management of capital projects and reduce their costs, as well as to explore non-traditional sources of financing. To a large measure, these efforts arose from experiences abroad and a philosophical perspective that greater private sector involvement in project delivery would reduce the need for publicly funded "New Start" fixed guideway construction.

The transit industry received initial exposure to turnkey from delivery of proprietary technology Automated Guideway Transit (AGT) systems in airport and theme park applications. These experiences were expanded in the Miami, Florida and Detroit, Michigan downtown people mover demonstration projects. Two extensive turnkey procurements for full, urban fixed guideway systems then followed in Honolulu, Hawaii and Houston, Texas. These latter cases incorporated innovative financing, joint development, advanced technology applications, and contractor-supplied operations and maintenance. While lack of political consensus kept Houston and Honolulu from advancing into construction, important lessons were learned which have been documented by FTA.

A number of issues, including a growing body of turnkey project experience, reinforcement of FTA's efforts in cost saving and innovative finance, and support of many transit industry representatives impressed with the opportunities for improved project delivery anticipated in Houston and Honolulu, prompted Congress to include Section 3019 in ISTEA. Section 3019 required that FTA approve no fewer than two projects to demonstrate turnkey procurement practices in an effort to "advance new technologies and lower the cost of constructing new transit systems."

A turnkey system undertaking was defined by Congress as “a project under which a recipient contracts with a consortium of firms, individual firms, or a vendor to build a transit system that meets specific performance criteria and which is operated by the vendor for a period of time.” Congress also permitted contract awards for turnkey-type procurements to be made to other than the lowest bidder when such an award leads to reduced long-term costs.

To fulfill the terms of Section 3019 of ISTEA, FTA initiated a project selection process and a series of industry outreach activities. FTA held a Pre-Proposal Conference on August 31, 1992 intended to open a dialogue with prospective participants about the turnkey method and provide details of the Demonstration Program.

FTA's primary objectives were to determine:

- If turnkey development could produce cost savings through more efficient and effective scheduling, allocation and management of project risk, cash management, subcontracting, and system operations.
- Administrative conditions needed to accommodate turnkey procurements more effectively.
- If turnkey contracting could stimulate more creativity in funding major transit capital investments.

By the end of November 1992, FTA had received 17 letters of intent to participate in the Program, from which eleven were invited to submit formal requests to participate. Ten proposals were in-hand by the end of February 1993. The proposals were evaluated by an FTA Task Force based upon; turnkey demonstration potential, local consensus, financial feasibility, understanding of project risk, management capability, and technical capability.

In April, 1993, four projects were selected to participate: Baltimore's Central Light Rail Transit Phase II Extensions, San Juan's Tren Urbano New Start Heavy Rail System, Bay Area Rapid Transit District (BART) San Francisco Airport Extension, and the Los Angeles El Segundo Del Norte Green Line Station. The Los Angeles selection was subsequently changed to the Union Station Gateway Project and a fifth demonstration site, New Jersey's Hudson-Bergen Light Rail Transit System, was added in 1995.

1.2 Turnkey Project Descriptions

The turnkey demonstration projects are described briefly below. Appendix A provides graphics of these projects and Appendix B identifies the primary members of the contracting teams, including Disadvantaged Business Enterprise (DBE) contractors:

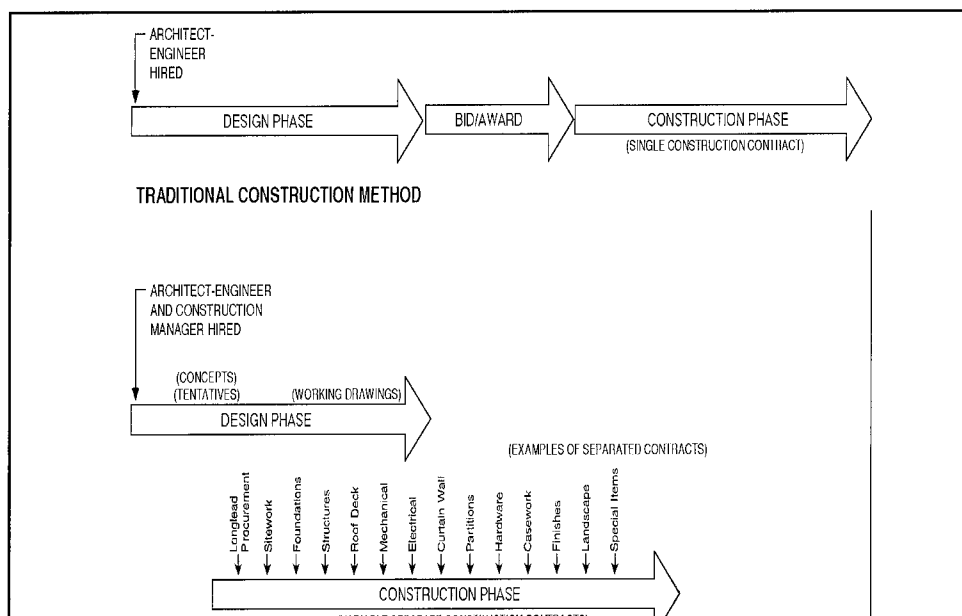
- **Baltimore Central Light Rail Line (CLRL) Extensions** - The Maryland Mass Transit Administration (MTA) opened its initial 22-mile light rail line in 1992. The project is comprised of three separate extensions totaling 7.5 miles in length and was estimated to cost \$108 million. A single design-build contract was used for the civil and systems work. The project is complete and slightly under budget.
- **San Juan, Puerto Rico Tren Urbano** - The Puerto Rico Department of Transportation and Public Works is advancing the Tren Urbano Project, a 10.7-mile heavy rail line estimated to cost \$1.55 billion. A turnkey contractor has been selected to provide all systems components, 64 vehicles, an initial (test track) line segment, two stations, an operations and maintenance (O&M) facility, and O&M for five years with a five-year extension option. A series of related bid packages for the civil construction of line segments, including a tunnel section, have been let and construction is underway.

- **Los Angeles Union Station Gateway** - The Los Angeles County Metropolitan Transportation Authority (LACMTA), through a private developer and a modified turnkey contract, has completed construction of a new LACMTA headquarters building and an intermodal terminal. The turnkey project cost was approximately \$150 million and the total undertaking represented \$295 million of construction. The project was completed within budget and required three change orders totaling slightly under \$1 million.
- **Bay Area Rapid Transit (BART) San Francisco International Airport Extension** - BART plans to use four separate design/build contracts to implement an 8.2-mile, four station extension to serve the San Francisco International Airport (SFO). The Federally funded portion of the project is estimated to cost \$1.248 billion. Design-Build contracting teams have been pre-qualified and will be selected on a low bid basis. Construction was initiated in August 1997 and revenue service is scheduled to begin in September 2001.
- **New Jersey Hudson-Bergen Light Rail Transit System** - New Jersey Transit is building an initial 10.5-mile light rail system along the Hudson River Waterfront using a design, build, operate, and maintain (DBOM) approach. In addition to final design and capital construction, the turnkey contractor will provide 15 years of operations and maintenance at a guaranteed cost, subject to adjustments for service levels and inflation. The procurement also includes new rail cars, a maintenance facility, and additional trackage for the Newark City Subway. The project is under construction and is expected to cost \$1.3 billion.

1.3 Turnkey in Relation to the FTA Project Development Process

Figure 1.1 provides a comparison of turnkey and conventional project development. By consolidating final design and construction, time delays due to sequential procurements are avoided. Not only are design and construction able to be undertaken in parallel, the number of procurements which are required is reduced considerably. Multiple, sequential bid/award cycles can alone add 12 to 24 months to project completion, as well as increase in-house staffing required for project administration.

FIGURE 1.1
Comparison of Turnkey and Conventional Project Development



A comparison of BART's experience on its East Bay Extensions, which were comparably priced and conducted conventionally, with the San Francisco Airport Extension turnkey project is a good case in point. The East Bay Extensions involved 26 prime civil contracts and 23 system contracts, while the Airport Extension will entail only seven contracts, plus work being advanced by the San Francisco International Airport.

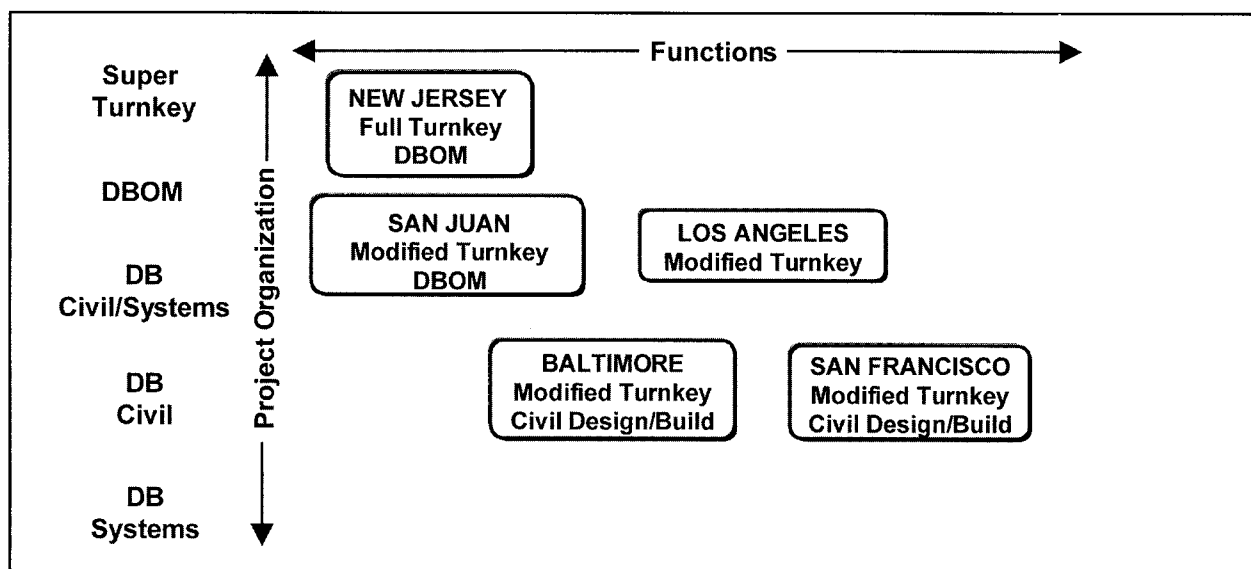
Consolidation of design and construction also permit flexibility in recovering schedules or budgets in response to unforeseen circumstances or changes in market conditions. For example, the Los Angeles Gateway Terminal Project was completed on time and within budget despite the Northridge Earthquake of 1994 (which necessitated re-welding the building's steel frame), the floods which followed shortly thereafter, and the administrative changes which occurred when the Southern California Rapid Transit District (SCRTD) and Regional Transportation Authority (RTA) organizations were merged to form the LACMTA.

In the Hudson-Bergen Project, considerable time-savings were achieved by conducting the turnkey procurement in parallel with completion of the Final Environmental Impact Statement (FEIS). Notice to proceed to the turnkey contractor coincided with the Record of Decision (ROD).

1.4 Turnkey Glossary

The nomenclature of turnkey¹ is subject to wide variation. The definition used by Congress provided in Section 1.1 assumes the combination of design, construction, and operations and maintenance. Figure 1.2 graphically portrays the range of turnkey alternatives represented by the five demonstration projects. The Hudson-Bergen project is described as a "DBOM" (design, build, operate, and maintain) because it represents a single contract for final design, construction (including rail cars and systems), and 15 years of operations and maintenance. It also has been described as a "Super-Turnkey" because proposers were required to submit financing proposals as part of their bids.

FIGURE 1.2
Turnkey Continuum



¹ Another term frequently used in connection with turnkey is "design/build". Under this approach, one entity is engaged for an entire project, or a critical element of a larger project, under a single contract for design and construction.

San Juan Tren Urbano is also classified as a “DBOM” because its primary contractor will be providing operations for five years, with a five-year renewal option. It is also shown as a “Modified Turnkey” because multiple contracts were bid for civil construction of guideway sections. The primary contractor is providing the rail cars and systems for the entire project, along with one line segment, two stations, the maintenance facility, integration of the overall undertaking, and operations and maintenance.

A similar pattern of multiple contracts (four design-build and three conventional) is being followed by BART; however, design discretion is limited due to the need for compatibility with the existing BART system, and operations will not be contracted. Baltimore’s approach involved a single contract for civil and systems construction that also was married to its existing LRT operation specifications, and will be operated by MTA. Los Angeles undertook a unique approach which involved establishing a public/private joint venture entity to build the Union Station Gateway Terminal. The joint venture then let multiple contracts to deliver the finished product.

In foreign experience and non-transit industry projects, public entities contract for projects using Build-Operate-Transfer (BOT) or Build-Own-Operate-Transfer (BOOT) arrangements because the project may generate net revenues which yield a return on capital investment. Use of turnkey methods facilitates private financing of such ventures because the risks of construction cost escalation, project completion and delay are shifted to the balance sheet of the turnkey contractor.

The wide range of options being tested under the Turnkey Demonstration Program portrayed in Figure 1.2 will help the transit industry adapt the fundamental principals of turnkey implementation to the unique circumstances of individual agencies and projects.

1.5 Industry Outreach

A critical factor in the success of the Turnkey Demonstration program was FTA’s extensive industry outreach effort. Since August, 1992, FTA has obtained input from all the disciplines involved in delivery of fixed guideway projects — finance, procurement, engineering, heavy civil construction, system suppliers, and even the surety industry. Table 1.1 provides a chronology of the demonstration program’s outreach and technical assistance efforts.

TABLE 1.1
CHRONOLOGY OF MAJOR EVENTS IN FTA TURNKEY PROJECT DEVELOPMENT

Date	Activity
December 18, 1991	The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) was signed into law with a section on Turnkey System Procurements and provisions for a Turnkey Demonstration Program.
February 25, 1992	FTA held a meeting with representatives of the World Bank on Build-Operate-Transfer (BOT) and turnkey Infrastructure Development.
June 1992	FTA published a report entitled: <i>Turnkey Procurement: Opportunities and Issues</i> .
August 13, 1992	Announcement of the Turnkey Demonstration Program in the <i>Federal Register</i> .
September 25, 1992	FTA received letters from 17 grantees of intent to participate in the Turnkey Demonstration Program.
February 23, 1993 .	FTA, through the American Society of Civil Engineers, sponsored a mini forum on Transit Turnkey Development in Washington, DC primarily

TABLE 1.1 (continued)
CHRONOLOGY OF MAJOR EVENTS IN FTA TURNKEY PROJECT DEVELOPMENT

Date	Activity
February 26, 1993	FTA received formal requests to participate in the Turnkey Demonstration Program from ten grantees.
March 10, 1993	FTA sponsored a Roundtable Seminar on Turnkey Development In Washington, DC primarily for representatives of Federal agencies, grantees and transit system equipment suppliers.
April 1993	FTA announced the selection of four turnkey demonstration projects: Baltimore Light Rail Extension, San Juan Tren Urbano, Los Angeles El Segundo Del Norte Station, and BART Airport Extension. Los Angeles subsequently substituted the Union Station Gateway Development project, and New Jersey's Hudson-Bergen Light Rail Transit System was added due to its extensive use of turnkey procurement principles.
April 30, 1993	FTA sponsored a Turnkey Roundtable Seminar for representatives of the finance industry in Washington, DC.
June 10, 1993	FTA and the American Public Works Association (APWA) sponsored a Turnkey Technical Workshop in Miami, FL.
March 4, 1994	FTA and the Volpe National Transportation Systems Center (VNTSC) sponsored the Turnkey Demonstration Program Expert Roundtable Workshop on Techniques for Successful Design/Build for Transit in Washington, DC.
November 16-17, 1994	FTA sponsored an expert roundtable workshop in Washington, DC which discussed all of the Turnkey Demonstration project experiences, but focused on the San Juan Tren Urbano Project.
May 4-5, 1995	FTA sponsored the Turnkey Demonstration Program Design and Construction Forum in Los Angeles.
February 23, 1996	FTA sponsored a meeting in Washington, DC to discuss Turnkey Demonstration Program risk management issues.
June 1996	The FTA Project and Construction Management Guidelines, originally published in September 1990, were updated to reflect advances in project management and finance including the turnkey procurement approach.
August 1996	FTA published the <i>Turnkey Evaluation Guidelines Final Report</i> .
October 15-19, 1996	FTA, the Transportation Research Board (TRB), and the Puerto Rico Department of Transportation and Public Works sponsored the International Transit Turnkey and Joint Development Workshop in San Juan, Puerto Rico.
October 1997	FTA published <i>Lessons Learned - Turnkey Applications in the Transit Industry</i>
November 18-19, 1997	FTA, MTA and PRDTPW sponsored forum on Technology Sharing and Professional Development in Baltimore, Maryland

FTA has also provided technical assistance to turnkey project sponsors through expert panels. The most recent one has been assistance to the National Park Service regarding the proposed Grand Canyon Light Rail System. These panels have reviewed procurement documents and offered advice on overcoming specific barriers when requested. Many of the demonstration project participants have found the increased level of information exchange an important factor in the success of their programs.

Initial outreach activities were oriented to potential participants in the Turnkey Demonstration Program and broad transit industry segments, such as engineers and contractors, system suppliers, and the financial community. More recently, there have been several expert forums to provide technical assistance to the selected demonstration program participants, and to offer opportunities for participants to share experiences with their peers, as well as the broader transit community.

The highlight of these activities was the International Transit Turnkey and Joint Development Workshop in San Juan, Puerto Rico. It was held in October 1996 and was sponsored by FTA, the Transportation Research Board (TRB), and the Puerto Rico Department of Transportation and Public Works (PRDTPW). The five-day conference featured experts from around the world and included five paper sessions and panel discussions on Joint Development and Finance, Procurement, Value Engineering/Design and Construction, Project Control, and Environmental and Risk Management Considerations. These papers are identified in Table 1.2 and represent a summation of FTA's knowledge base for turnkey implementation. They reflect the cutting edge of turnkey experience in public transit today.

As explored in the next chapter, one of the greatest impediments to the development of turnkey implementation is the inability of many FTA grantees to initiate procurements by competitive negotiation, rather than sealed bids. While federal legislation and rule making has permitted more flexibility in selection of procurement methods by federal agencies over the years, FTA grantees are often constrained by state and local statutes, as well as federal acquisition regulations.

To address this critical need, FTA convened a working team of its legal and program staff to draft a model competitive negotiation statute for states and localities that would be in compliance with federal acquisition regulations. FTA's staff also undertook development of a handbook which documented the range of authorities available nationally for transit agencies to conduct competitive negotiations. This assignment was completed in early 1997 and also yielded model statutes for competitive negotiation of professional services (architect/engineering services and non-architect/engineering services) and design/build projects.

TABLE 1.2

Resource Papers Presented at the International Transit Turnkey and Joint Development Workshop

Title:	<i>Turnkey Financing for Public Transportation Projects</i>
Author:	Roger S. Figura, KPMG Peat Marwick, McLean, Virginia
Title:	<i>Procurement and Subcontracting</i>
Authors:	Bedros Enfiedjian, Gardner Consulting Planners Carson, California and W.H. (Ray) Lytle, Jr., JRL Associates, Inc. McLean, Virginia

TABLE 1.2 (continued)

Resource Papers Presented at the International Transit Turnkey and Joint Development Workshop

Title:	<i>Value Engineering, Design and Construction</i>
Author:	Thomas J. Luglio, Jr., EG&G Dynatrend Bryn Mawr, Pennsylvania
Title:	<i>Environmental Considerations</i>
Author:	Diana Mendes, BRW, Inc. Newark, New Jersey
Title:	<i>Risk Allocation</i>
Author:	Douglass B. Lee, USDOT Volpe National Transportation Systems Center Cambridge, Massachusetts
Title:	<i>Project Management Control</i>
Author:	Donald C. Schneck, Booz-Allen & Hamilton, Inc. Philadelphia, Pennsylvania

Experiences in innovative transit procurement approaches also are reflected in the 1996 *Update of the FTA Project and Construction Management Guidelines*. Additionally, FTA has continued to develop cost benchmarks for Heavy Rail and Busway/HOV fixed guideways with the publication in September 1994 of *Fixed Guideway Capital Costs*. These benchmarks will facilitate comparisons with turnkey undertakings.

1.6 FTA Turnkey Demonstration Program Oversight and Evaluation

Oversight efforts are underway for each of the five projects. The documented results of these cases will be compared to similar, conventionally delivered transit projects. The comparisons will be designed to establish whether time and cost savings occurred, and assess any improvements realized in procurement, finance, project management, construction, systems acquisition, new technology applications, and operations and maintenance.

FTA has assigned consultants knowledgeable of conventional and turnkey implementation and project management to provide oversight and reviews of each demonstration site. These efforts are following the evaluation methodology developed by the U.S. Department of Transportation Volpe National Transportation Systems Center in its August 1996, *Turnkey Evaluation Guidelines* (FTA-MA-90-7012-96-1). The recommended evaluation procedure is an application of benefit-cost analysis (BCA) principles and consists of:

- Construction of a base alternative (counter-factual) against which to compare the impacts of the turnkey variation used in the given prototype demonstration site;
- Estimation of the impacts of the turnkey alternative;
- Translation of the impacts into measures of net benefits; and
- Determination of the key factors leading to favorable results.

2.0 THE GROWTH OF TURNKEY AND CHALLENGES TO ITS APPLICATION IN TRANSIT

FTA's introductory report on turnkey, *Turnkey Procurement: Opportunities and Issues* (1992), identified the limitations of "design-bid-build" and stimulated experimentation with new approaches to public works acquisition around the world. These trends have accelerated as:

- The Design/Build Institute of America (DBIA) was created;
- Professional organizations such as the American Society of Civil Engineers (ASCE), the American Consulting Engineers Council (ACEC), and DBIA sponsored publications and conferences on design/build;
- Design/build emerged as a special area of contract law;
- Federal, state, and local procurement regulations permitted broader authority for design/build and two-step procurements; and
- Internal Revenue Service (IRS) private activity restrictions on tax-exempt debt have been liberalized.

The growing popularity of turnkey is demonstrated by the fact that in 1997, FTA identified at least six of its 16 projects approved for preliminary engineering as pursuing innovative procurement strategies. Recent trade articles indicate an accelerating trend toward turnkey:

- According to *Civil Engineering News* (September, 1997, p. 17), a survey conducted by Zweig White & Associates of design and design/build firms states that the median percentage of gross annual revenues derived from design/build projects doubled from five percent in 1995 to ten percent in 1996. The gross annual receipts derived from design/build projects for construction firms increased ten percent over the same period and the number of design/build projects rose 81 percent for roads, bridges, and railways.
- DBIA reported in *Civil Engineering* (September, 1997, p. 56) that since 1987, the domestic volume of design/build construction increased from \$6 billion to \$56 billion per year. In the same edition of *Civil Engineering* (p. 18), another article noted that the San Francisco Civic Center will be completed in five years using a design/build approach compared to ten years that would have normally been required under conventional methods.
- *Engineering News Record* (May 24, 1993) noted that design-build is being used on nearly one-third of the construction volume in the US and nearly one-half of the work being done internationally. ENR also indicated that design/build activity among the top 400 US contractors has exceeded \$80 billion (domestic and international).

2.1 FTA's Early Models - Houston & Honolulu

In the early 1990's, fixed guideway concepts were promoted in Honolulu, Hawaii and Houston, Texas on the basis of private participation in financing, extensive joint development contributions, and turnkey acquisition methods actually moved forward into procurements. These efforts resulted in the selection of turnkey constructors and system suppliers, as well as substantial federal funding commitments.

The promise of Honolulu's Rapid Transit Program caused it to advance quickly through the federal project approval process. FTA provided technical assistance in adjusting federal procedures to a non-conventional procurement to design, build, operate, and maintain a 16-mile, fully automated, fixed guideway, rapid transit system. After selecting a turnkey consortium, receiving substantial federal funding commitments, completing preliminary engineering and the environmental process, the project was aborted for lack of

With the program, as manifested by City Council's failure to enact a needed turnkey...

In addition to using the Honolulu experience to review its project management requirements, FTA supported the turnkey application for construction of the Houston Fixed Guideway Component. Houston's project also involved considerable joint development, with a requirement that 12.5 percent of the project be privately-funded. Financing was less of an issue in Houston than in Honolulu because the transit agency had accumulated sufficient reserves from its dedicated tax to build much of the project from cash on hand and federal commitments. Instead, a political consensus to emphasize rail transit over highways was never really established. A mayoral election resulted in defeat for the incumbent who supported the rail program and budget priorities quickly shifted to local streets, highways, and bus improvements.

The Honolulu and Houston projects failures were due to the uncertainty inherent in local political processes, not substantial weaknesses with the projects. Nevertheless, the Honolulu and Houston experiences encouraged the promise of future turnkey initiatives in mass transit, especially for new transit systems using advanced technology, provided that political risk was addressed early in the process.

2.2 *Highway Design/Build Experiences*

Transit District fixed guideway civil construction is performed primarily by firms with highway contracting background. The highway field is undergoing an accelerating shift in procurement practices toward more innovative methods. The Transportation Corridor Agency toll roads in Orange County, CA, the Dulles Greenway in Virginia, and Puerto Rico's San José Lagoon Bridge, all represent substantial design/build construction programs involving some of the nation's largest and most experienced constructors and designers in new, "greenfield" construction programs. The SR-91 High Occupancy Toll Lanes in Orange County, CA and the reconstruction of I-15 in Salt Lake City, Utah represent major design/build construction programs within existing rights of way.

The \$1.3-billion I-15 Project in Utah signals a basic shift in the application of design/build from "private" toll facilities whose goals included user-fee based financing, to mainstream, publicly-funded construction; and from building new roads to reconstruction of existing highways.

Reconstruction activity is increasing dramatically due to the changing emphasis of categorical funding programs, aging of the interstate system, and the need for safety and capacity improvements. Land acquisition uncertainties for reconstruction are greatly reduced, geotechnical conditions are generally well known, as-built drawings are frequently available for structures and utilities, and improved designs and intelligent transportation systems permit increased capacity and safety within the same right of way envelope. These factors also reduce many of the uncertainties owners and contractors face in design/build public works projects.

The primary motivations for UDOT's decision to advance the I-15 Project using design/build were: to accelerate completion by three years over normal methods in order to coincide with the 2001 Winter Olympics, to implement a single project about five times the magnitude of the entire state highway program, and to tap innovative methods and designs not previously applied in Utah.

Bid prices for the I-15 project were within budget expectations, while the schedule proposed by the winning team will complete the project three months ahead of UDOT's baseline. The project involves the reconstruction of 16 miles of freeway and interchanges. Replacement of 137 bridges will be required. Three bids were received and were less than 6 percent apart, with the winning team also supplying the lowest bid. The procurement was based upon "best value" and could have resulted in an award to other than the low bidder. No vendor financing was requested. Utah is an "AAA" credit and is supplying funds for the project from General Obligation municipal debt in order to minimize interest expense.

The I-15 Project includes a number of innovative features:

- A 10-year operating and maintenance component intended to address owner concerns regarding known settlement issues, help assure the quality of the end-product, and share risks for the application of innovative designs, methods and materials.
- \$50 million in award fees for superior performance, quality, and schedule adherence.
- \$100 million in maximum liquidated damages for failure to meet the scheduled completion date.
- Stipends of \$950,000 each to losing proposers for use of ideas and methods.
- Development of preliminary engineering by multiple design firms freed to team with proposers and an extensive industry review process.
- Use of tangible net worth and credit rating targets, corporate guarantees, and joint and several liability to cover completion risk exposure in excess of surety coverage.

Utah's publicly-funded/reconstruction application of design/build is now being extended to Colorado (I-70 pavement rehabilitation), Oregon (I-5 bridge rehabilitation), Maine (Carlton Bridge replacement), Indiana (I-65 rehabilitation) and Florida. In cases such as Indiana, Maine, and Colorado, the shift to design/build methods has been prompted by a significant increase in contracts being let, limitations on in-house design staffs, and the evolving nature of construction requirements — a shift from “greenfield” projects to rehabilitations and reconstructions on existing rights of way.

Maine's highway program typically receives about \$90 million in federal funding, with about \$20 million used for bridges. In 1995, the Maine bridge replacement program received \$200 million. Design/build was tapped as a means to advance a larger portfolio of bridge replacement projects than in-house capabilities would have normally permitted. Similar techniques were used by CalTrans in the aftermath of earthquakes and floods in the mid-1990's.

Florida's experimentation with innovative procurement methods for highway construction arises from a desire to reduce delays in project delivery and minimize claims and change orders. In 1996 the State Legislature approved the expenditure of \$60 million on a variety of innovative procurement strategies, including: lane rental charges, bid averaging, A+B bidding (construction cost plus a factor for construction days multiplied by a daily charge), design/build minor (less than \$10 million), warranty bids (to guarantee pavements, painting and stripping for more than one year), and “no excuse bonus bidding” (no time extensions to qualify for bonus payments and bonuses for accelerated completion).

The Florida Department of Transportation's (FDOT) use of design/build for emergency replacement of the 3,000-foot I-10 Blackwater River Crossing, damaged by Hurricane Opal in late 1995, is estimated to have saved three years over conventional methods. The \$30.4-million project was to be completed in 627 days, but the design/build contractor finished about 60 days early. The bulk of the time savings, however, was in moving the project through the FDOT design and contracting process in less than three months, rather than the usual three years.

2.3 *Overcoming Institutional and Legal Barriers*

In advancing as the preferred method for many public works undertakings, turnkey procurement has overcome a wide variety of legal and institutional barriers. The BART Airport Extension and San Juan Tren Urbano projects have required special state legislation, while the New Jersey Hudson-Bergen project required waivers from federal acquisition regulations in order to include an operating and maintenance component extending for 15 years. The large dollar size of the contracts for the New Jersey Hudson-Bergen, San Juan Tren Urbano and BART Airport Extension projects necessitated consideration of waivers from

100 percent surety bond coverage requirements. In these cases, bidders have agreed to accept the excess liability on their balance sheets for their own performance, as well as joint and several liability for the performance of their co-venturers.

At the Federal level, there were regulatory issues involving Pre-qualification, Third Party Contracts and private activity issues that needed to be addressed. There was also state and local statutes which needed to be modified or waived before these projects could commence. The following discussion highlights many of these other concerns thus far.

2.3.1 Federal Regulatory Issues

In 1996, President Clinton signed into law new flexibility for federal agencies to utilize design/build as a project delivery strategy. The Federal Acquisition Reform Act, known as "FARA," now permits federal agencies broader authority to pre-qualify or short-list eligible proposers under "two-step" procurements. It represents the first significant modification in federal procurement of architecture and engineering services since passage of the Brooks-Architect-Engineers Act in 1972. The law sets forth specific guidelines for the use of design/build in cases where the following criteria are met:

- Adequate project definition,
- Established time lines for project delivery,
- Potential contractor experience and capability,
- Suitability of the project for a two-phase selection process,
- Capability of the agency to manage a two-phase selection process, and
- Other criteria established by the agency.

Subsequent modifications to federal regulations have now been published which implement this key piece of legislation. The Federal Register (Vol. 61, No. 153, August 7, 1996) permits the Department of Defense, the General Services Administration, and the National Aeronautics and Space Administration to broaden their use of design/build when contracting for construction, including use of a two-step selection process. These latest regulations modify 48 CFR Part 1 FARS (Federal Acquisition Regulations System), Part 5 (Publicizing Contract Actions), Part 14 (Sealed Bidding) and Part 36 (Architect-Engineer Contracts).

FTA Circular 4220.1D specifies the procedures grantees must follow in the solicitation, award and administration of third party contracts. These requirements are based upon the Common Grant Rule, Federal Statutes and Executive Orders. Accordingly, procurements are to be conducted in a manner providing:

- Full and open competition,
- Prohibition against geographic preferences, and
- Pre-qualification criteria which assure sufficient qualified sources for maximum full and open competition.

With the exception of the inferred language in ISTEA allowing design/build for transit projects, FTA statutes are generally silent relative to the ability of local transit grantees to procure projects utilizing turnkey approaches.

Tax exempt financing is a feature of most public transit investments and the five turnkey demonstration projects are no exception. The Hudson-Bergen Light Rail project encountered a serious complication in the use of tax exempt financing. Internal Revenue Service regulations in effect at the time the procurement was

undertaken appeared to classify the project as a private activity because of the 15-year operations and maintenance period. Tax exempt debt still could have been issued for the project if sufficient capacity was available and allocated by the State under its private activity bond cap. Given the magnitude of the financing requirement, anticipating an allocation of the private activity cap was perceived as a high risk by New Jersey Transit during the procurement process.

Revisions to the IRS regulations published subsequent to award of the Hudson-Bergen DBOM contract permit extended operations and maintenance periods for projects such as mass transit which do not generate net profits. The latest IRS regulations on private activity have liberalized tax exempt financing options for DBOM procurements. In the Hudson-Bergen case, the change permitted a \$347 million tax exempt grant anticipation financing to be undertaken in lieu of higher cost vendor financing proposed under the turnkey bid requirements.

2.3.2 State and Local Issues

State and local statutes can limit an FTA grantee's ability to initiate a turnkey procurement. The law offices of Nossaman, Guthner Knox & Elliott (NGKE) have published results of a state-by-state survey of legislative authority for design/build procurements in the transport sector.² The results are shown in Table 2.1. The survey found that ten states clearly authorize design/build, and another 11 appear to offer more limited turnkey opportunities. The other 29 states either have "no position" or are unclear on the issue. Many of the 21 states which permit some form of turnkey procurement have enacted the necessary legislation within the last three to five years.

The rate of change has accelerated, particularly in states where turnkey demonstration projects are being conducted. For example, enacted in June of 1997, New Jersey's Public/Private Partnership Act (S1746/A2560) authorized the New Jersey Department of Transportation to undertake negotiated procurements for seven public-private transportation projects over the next five years. Projects already in the state transportation plan can be negotiated without legislative oversight. Allowable demonstration projects include: gateway rest areas, rail and highway access to ports, highways and bridges, rail station rehabilitation, air rights, light rail systems, rolling stock sale-lease backs and technology partnerships.

Public transit agencies have historically used procurement strategies using "low bid" without pre-qualification. These strategies are in sharp contrast to the private sector which often bases its procurement decisions on price and other factors, such as quality or time savings. All of the turnkey demonstration projects followed a two-step procurement which entailed pre-qualification. Baltimore MTA, LACMTA, and BART awarded contracts based upon the lowest sealed bid submitted by the pre-qualified contractors. New Jersey Transit and San Juan Tren Urbano considered price, as well as other weighted factors, such as technology or operations and maintenance approach. San Juan Tren Urbano also negotiated a best and final offer (BAFO). LACMTA negotiated the best value for each contract package.

² Kenneth M. Roberts and Nancy C. Smith, Public Contract Law Journal, Design-Build Contracts Under State and Local
N. J. TRANSIT, 1997, 25 P. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100. American Bar Association.

TABLE 2.1
Fifty State Survey of Design/Build

STATE	AUTHORITY/JURISDICTION	POSITION ON DESIGN/BUILD
Alabama	State/County/Local	Unclear
Alaska	All agencies for projects using state funds, subject to determination by Chief Procurement Officer	Yes
Arizona	State Transportation Board	Yes
	Department of Transportation	Yes
	Other State and Local Agencies	Problematic
Arkansas	State Agencies and Political Subdivisions	Problematic
California	CalTrans	Yes
	BART	Yes
	West Bay Rapid Transit Authority	Yes
	Los Angeles MTA	Yes
Colorado	Department of Transportation (Public-Private Partnerships)	Yes
Connecticut	State	In general, problematic with exceptions
Delaware	State	Unclear
District of Columbia	District	Problematic
Florida	State: subject to Consultants Competitive Negotiation Act	Yes
Georgia	Highway Authority	Yes
Hawaii	Honolulu Transit Authority	Yes
Idaho	Other agencies	Problematic
Illinois	State	Problematic
Indiana	State/local Administrations	No
Iowa	Transportation	Unclear
Kansas	Turnpike Authority	Yes
Kentucky	Department of Transportation	Problematic
Louisiana	State agencies	Problematic
Maine	State	Unclear
Maryland	Capital Projects	Yes
Massachusetts	Capital facility projects	Yes
Michigan	Highways and motor vehicles	Unclear
Minnesota	State highways and local transportation	Unclear
	Metropolitan Transit (light rail systems)	Yes
Mississippi	State/local	Problematic
Missouri	State	Problematic
Montana	Department of Transportation	Yes
Nebraska	State/Counties	Problematic/Unclear
Nevada	State Public Works Board	Yes
New Hampshire	Capital Budget Projects	Yes
New Jersey	Transit	Yes
New Mexico	All other agencies	Unclear
New York	Metropolitan Transportation Authority	Unclear
	New York Transit Authority	Unclear
North Carolina	Department of Transportation "CARAT" System	Yes
North Dakota	State	Problematic
Ohio	State	Problematic

TABLE 2.1 (continued)
Fifty State Survey of Design/Build

STATE	AUTHORITY/JURISDICTION	POSITION ON DESIGN/BUILD
Oklahoma	All state and local agencies	No
Oregon	Department of Transportation	Yes
Pennsylvania	State	Problematic
Rhode Island	State	Unclear
South Carolina	Department of Transportation	Unclear
South Dakota	Public Works	No
Tennessee	Transportation	Unclear
Texas	High-Speed Rail Authority	Yes
Utah	All agencies	Yes
Vermont	State	Unclear
Virginia	All state agencies; various local agencies	Yes
Washington	Department of Transportation: (Public/Private Authority)	Yes
West Virginia	State/local/county	Problematic
Wisconsin	State	Yes
Wyoming	Department of Transportation, cities and towns, county bridge projects	Problematic
Puerto Rico	Department of Transportation	Yes

Source: The law firm of Nossaman, Guthner, Knox & Elliott, Los Angeles, CA September 1996

2.3.3 State-by-State Survey - Demonstration Project States

The five design-build demonstration projects are in California, Maryland, Puerto Rico, and New Jersey. The following discusses the specific state statutes which affected the five turnkey demonstration projects³ and what legislative steps the agencies took to rectify licensing law obstacles.

CALIFORNIA

The California Code permits partnerships between architects and non-architects, but requires the architect's name to appear on all instruments of service, such as blueprints, drawings, etc. and bars the designation of any non-architect as an architect. Joint ventures may face an additional hurdle. A joint venture composed of two or more licensed contractors must obtain a joint venture license in order to be awarded a contractor or act as a contractor.

BART: The Bay Area Rapid Transit District (BART) sought and obtained special State legislation codified as California Public Contract Code 20221.1. Under this statute, BART could proceed, using a request for qualifications which identifies the minimum standards that the District had determined should be met, or exceeded by a contractor to successfully design/build the San Francisco Airport extension project. A minimum of three firms would be pre-qualified for the District to proceed to bid stage. Only those firms which had been pre-qualified were eligible for award of a contract. The statute allows pre-qualification (an area of particular concern to BART, since they were previously involved in litigation concerning pre-qualification), and requires that the project be awarded to the low-bidder. This request was then forwarded for approval through the FTA Office of Procurement and the Administrator, to the U.S. DOT

³ See Park, John J., E. Mabry Rogers and Walter J. Sears III, "Chapter 3: The Effect of Licensing Laws on Design-Build" Projects, *Design-Build: A Practical Guide*, McGraw-Hill, 1996, pp. 100-101.

Assistant Secretary for Administration in Washington D.C. The Office of Small and Disadvantaged Business was called upon, to ensure that there was no adverse impact on the small and disadvantaged program.

BART sent a request for a one-time exemption from the pre-qualification requirements of 49 CFR 18.36 (c) (4) to the Regional Administrator of FTA Region 9 Office. In its letter, BART stated that it placed advertisements for the pre-qualification in major national and state publications, sent advanced notices of the pre-qualification documents to over 1000 firms, including all organizations that contributed to, or inquired about, design/build industry review, and were identified in the District's design/build database. This effort is consistent with FTA C 4220.1D (8) (d), which states that "grantees shall ensure that all lists of pre-qualified persons, firms, or products that are used in acquiring goods and services, are current and include enough qualified sources to ensure maximum full and open competition.

LOS ANGELES COUNTY MTA: The Los Angeles Union Station Gateway was accomplished through the California Public Utilities Code Section 130242 (SB 616) which allows for turnkey projects to be competitively bid. SB 616 was conceived as authorization allowing 'bundling' of different types of work, in order to allow a true turnkey project. The legislature limited its usefulness, by requiring competitive bidding to be used. California Public Utilities Code Section 130238 has been in place for a number of years and it allows competitive negotiation of specialized transit equipment.

MARYLAND

The Maryland Business Occupational and Professional Code is the primary legal instrument related to licensing. It requires persons to be licensed before practicing architecture. It permits licensed architects to practice architecture for others through corporation or partnerships and permits a corporation or partnership to provide professional services through a licensed architect. Corporations and partnerships must also meet compositional requirements, which include the requirement that at least two-thirds of the directors or partners be licensed in Maryland or another state. In addition, a licensed Maryland architect must be in responsible charge of the architectural practice. In anticipation of several design-build projects in this decade, the Maryland State Finance and Procurement Code 3-602 (1991) - Capital Projects - specifically lists design-build as an alternative construction method that should be considered for capital projects.

MARYLAND MTA: Baltimore's Phase II Central Light Rail Line Extension was awarded using a two-step process, with pre-qualifications, followed by competitive bidding. No special legislation was enacted, and the process followed the requirements of State Procurement Regulations COMAR⁴ 21.05.02.17.

NEW JERSEY

New Jersey law defines practicing architecture firms in terms of "rendering" professional architectural services. The law permits sole proprietors or business associations that may render engineering services to contract to provide architectural and engineering services if (1) the proprietor or association contracts with the owner in writing for the coordinated rendering of architectural and engineering services, and (2) the architectural services are provided pursuant to a separate written subcontract. The subcontract must provide: "The licensed architect shall exercise independent professional judgment consistent with accepted standards of the practice of architecture with regard to the project as its circumstances may dictate." Thus, a design-build single entity appears to be infeasible while a joint-venture approach, or a design-build contractor with the designer as the lead, appears to be feasible.

⁴ The Maryland Transit Administration (MTA) follows the Code of Maryland Regulations (COMAR) in procuring the design and construction of state funded capital projects. State rules and regulations are published in the Maryland Register and codified in the Code of Maryland Regulations (COMAR).

NEW JERSEY TRANSIT: The New Jersey Transit Hudson-Bergen Line turnkey procurement did not receive any special legislation because all of the bidders were joint-ventures, and therefore was permitted under State procurement laws.

PUERTO RICO

Licenses are available only to residents, unless a designer forms an association with a designer licensed and domiciled in Puerto Rico, or a designer of “renown or international prestige.” Failure to comply with the licensing provision is a misdemeanor, but the statute is silent as to rights to enforce contracts. More importantly, Puerto Rican law makes it necessary to initiate a joint venture for design-build contracts.

PUERTO RICO ACT: The San Juan Tren Urbano project is being accomplished by an existing Puerto Rico law. An addendum amendment authorizes turnkey delivery of transportation projects in general.

San Juan sent a request for waiver of the 100 percent bonding requirement to the regional Administrator of FTA Region 4 Office, and then forwarded to the FTA Office of Procurement in Washington D.C. In its initial letter, the grantee stated that the surety market could not provide 100 percent bonding, but only 50 percent. FTA in its initial response back to San Juan, requested more information, specifically:

- A description of the process employed to evaluate proposals.
- A summary of the successful bidding teams, including criteria such as financial capacity, technical merit, backlog of projects, and transit experience.

Once this information was received by the Office of Procurement, an approval was given. In its approval, the FTA took the position that this did not constitute a waiver, because the bonding requirements set forth in the Common Grant Rules and FTA C4220.1D apply to construction and not to turnkey procurements. It noted that since this was not a departure from the minimum standards set-forth in the Common Grant Rules, it was not necessary to process a request for waiver through the FTA Administrator and the Office of the Secretary. However, since it was precedent setting and involved the turnkey program, FTA was exercising its rights to review and concur, or non-concur, in a matter that was of special interest to FTA. This is consistent with Section 5 (a) (b) FTA C 4220.1D.

3.0 FACTORS AFFECTING TURNKEY INITIATIVES IN PUBLIC TRANSIT

There are key variables common to all five turnkey demonstration projects that impact the risks and probabilities for successful project delivery — that is, delivery of a completed scope within budget, on schedule, and performing as planned. These variables are summarized in Table 3.1 and are followed by a brief discussion as they relate to the demonstration sites.

TABLE 3.1
Overview of Key Variables

	Baltimore	Los Angeles	San Juan	BART	Hudson-Bergen
Complexity	Moderate	Low	High	High	High
Experience	High	High	Low	High	High
Cost	Low	Moderate	High	High	High
Contracts	Single	Multiple	Multiple	Multiple	Single
O&M	No	Yes	Yes	No	Yes
Financing	No	Yes	No	No	Yes
Definition	High	Moderate	High	High	High
Land Acq.	Yes	Yes	Partial	Yes	Yes
Technology	Existing	Existing	New	Existing	New
Site Control	Moderate	High	Low	Low	Low
Status	<i>Complete</i>	<i>Complete</i>	<i>Construction</i>	<i>Construction</i>	<i>Construction</i>

Source: Jeffrey A. Parker & Associates, Inc., 1997.

3.1 Project Definition

In all instances the level of project definition appears to be relatively high. During the Preliminary Engineering phases, the demonstration project sponsors, based on the Honolulu and Houston experiences, exceeded the 30 percent of Final Design typically produced in Preliminary Engineering. Proposers for the fixed guideway projects received relatively detailed sets of specifications for a variety of reasons. BART has complex system interfaces with the existing network which cannot be modified and the same is true to a lesser degree in Baltimore. Both BART and New Jersey Transit negotiated extensive design features in order to gain political and institutional sign-offs which had to be reflected in the construction, even though a private contractor might not require the specified features or finishes to provide a functional end-product.

San Juan Tren Urbano's specifications were relatively detailed due to a desire to apply the latest technologies and to meet the requirements of system planners. Tren Urbano, as well as the Kennedy Airport Rail Link and the South New Jersey Light Rail project, represent projects whose plans and specifications were devised from the outset for a DBOM procurement. The Hudson-Bergen project plans were well advanced in anticipation of a conventional procurement prior to the decision to shift to DBOM, while BART and Baltimore were constrained by having to integrate with existing systems.

3.2 Complexity

Complexity is a driving risk factor which encompasses the degree of systems integration, the length and duration of the construction activities and the nature of the civil construction (tunnels, elevated sections). Both the Baltimore Central Light Rail Extensions and Los Angeles Union Station Gateway present the lowest complexity profiles, which probably is best reflected by the fact that these projects are already completed.

The Baltimore and Los Angeles projects involved more manageable complexity risks due to the smaller scale of the projects, relatively low technology levels, and only a limited amount of difficult construction. The San Juan Tren Urbano rail system has a high level of technology content, along with complex civil construction that includes a tunnel section and aerial segments in densely-developed areas. The Hudson-Bergen Initial Operating Segment (IOS) involves relatively straight-forward construction and proven technology. The BART program is like the Baltimore program in that it is an extension and is not deploying new operating technology. Unlike Baltimore, the BART Airport Extension involves tunnel construction, plus complicated interfaces with other construction being performed by the San Francisco International Airport and adjacent to an operating railroad.

3.3 Owner Experience

High technology rail transportation and extensive tunneling in an urban area are new to Puerto Rico. Tren Urbano is the largest single public works project ever undertaken in Puerto Rico's history. To compensate, the Puerto Rico Highway and Transportation Authority (PRHTA) expanded the systems integration and quality control tasks.

By contrast, BART and Baltimore MTA are experienced with the technology and types of construction their turnkey projects entail. Even though the BART project is highly complex from both the civil and systems perspectives, the agency's construction experience is significant and mitigates the inherent risks ahead. New Jersey Transit is familiar with commuter rail and light-rail technology, but the light rail vehicles being supplied for the Hudson-Bergen project will be new to the agency, as will the challenges of running part of the rail line at street level through neighborhood areas. The Los Angeles Union Station Gateway project, while different from the heavy civil and systems requirements of its rail endeavors, represented relatively straight-forward construction by contrast.

3.4 Cost Control

The sheer magnitude of dollars required for implementation represents a serious financial risk to both the owner and the turnkey contractor. Each of the turnkey demonstration projects is working with a FTA Project Management Oversight (PMO) contractor to assure budget adherence.

3.5 Contracts

The Baltimore Central Light Rail Extensions and New Jersey Hudson-Bergen projects involve single contracts for the entire scope, while Los Angeles Union Station Gateway and San Juan Tren Urbano let multiple contracts, which are integrated by a lead turnkey entity. The Baltimore project was awarded to Whiting-Turner, Inc. to physically build the extensions, and to provide system integration to the existing system. A team led by Raytheon Engineers and Constructors, Inc., called Twenty-First Century Rail was the winning bidder for the Hudson-Bergen project. The team includes Kinkisharyo (USA), Inc. and Itochu Rail Car Inc. Raytheon Infrastructure Services Incorporated, a subsidiary of Raytheon Engineers and Constructors, will serve as the general contractor for Twenty-First Century Rail and Kinkisharyo (USA), Inc. and Itochu will build and maintain the rail vehicles.

The Los Angeles project was contracted to a single joint venture entity, Union Station Gateway, Inc., a non-profit entity comprised of LACMTA and the developer, Catellus Corporation. The joint venture entity then let multiple contracts to build the project. By using this approach, LACMTA was able to move the project outside of its regular procurement processes, resulting in an estimated time savings of 12 - 15 months, as well as a completed undertaking within budget and with only a single minor change order.

The San Juan Tren Urbano project used a modified turnkey procurement approach. The Systems and Test Track Turnkey contract (STTT) combines vehicles, train control, trackwork, traction power and distribution, signals, escalator/elevators, fare collection, and communications. The civil design/build portion were separated into six Alignment Section Contracts (ASC). The STTT portion was awarded to Siemens Transit Team, as part of Siemens Transportation Systems.

BART's multiple contracts have well defined interface requirements, but BART is ultimately responsible. These differing strategies arise from:

- Differing turnkey philosophies, project scopes and level of prior project development,
- Owner agency's experience base, organizational structure, procurement constraints, and political environment,
- Desire to maximize the participation of local firms,
- Magnitude of the contracts involved, and
- Risk allocation structure preferred by the owner.

3.6 *Operations and Maintenance*

Congress' interest in assessing the influence of contractor-supplied operations and maintenance on life cycle costs and service quality will be tested in San Juan and New Jersey. The 15-year operating and maintenance period for New Jersey Hudson-Bergen, and 5-year period plus option for San Juan Tren Urbano, will be unique in the transit industry.

3.7 *Innovative Finance*

Innovative financing was an area of strong interest to FTA and Congress in undertaking the Turnkey Demonstration Program. The Hudson-Bergen project yielded tangible financing offers from proposers because finance proposals were made mandatory through design of the bid pricing mechanism. Bid prices had to include accrued interest to account for construction within 42-months and payment over a potential six to nine year period. Maximum payments on a quarterly basis were mandated to reflect New Jersey Transit District anticipated flow of capital revenues during the construction period and into the subsequent operating period. The payments were characterized as progress payments because the State Attorney General had ruled that New Jersey Transit could not incur debt. The borrowing obligation therefore had to be incurred by the proposer, who received funds from a bank in anticipation of the future progress payments from New Jersey Transit. New Jersey Transit District specification further called for no progress payments to be made for the rail vehicles. A single bullet payment was to be provided upon initiation of revenue service. The vehicle price bid included all accrued interest, along with inflation and any currency hedges.

Los Angeles' Gateway Terminal also achieved unique and innovative joint development benefits. The existing Union Station Gateway complex is only the first phase of this mega-complex known as USG. Phase I of USG comprises Union Station, an historic landmark, a new 26-story headquarters building for the LACMTA, a 2,500-space underground parking garage, and an intermodal center which links the Red Line subway, Metrolink commuter rail service, Amtrak, future LACMTA rail lines and local and regional bus services.

The immediate site is envisioned to encompass over 2.5 million gross square feet of office, hotel and retail development adjacent to the promenade (see Appendix A, Los Angeles Union Station Gateway).

The structure of the garage was enhanced to include the footings for two future office towers alongside the transit plaza at a public cost of \$600,000. In exchange, the developer is obligated to pay LACMTA \$8 million, plus agreed interest, to use the footings when the towers are built. A Benefit Assessment District was created to pay for the foundations, parking spaces, freeway connection ramps, realigned roadways, utilities, landscaping, and art. Separate common area charges are assessed to cover maintenance of the transit plaza and the gardens along the promenade. In addition, it is anticipated as the site is built-out in the future, the prospective developer will replace or reimburse LACMTA for a portion of the parking capacity built into the underground garage. A Master Plan for the total site, most of which originally served an extensive Southern Pacific rail yard owned by Catellus Corporation (whose origins trace back to the Southern Pacific Land Company), is completed and has zoning approval for approximately 7 million square feet of mixed use development.

Tren Urbano is being funded through traditional highway user fees (tolls, gasoline taxes and registration fees) and a petroleum tax levied by the Commonwealth on imported oil. Funding is also expected from a planned extensive joint development program. Both Los Angeles and BART use tax-exempt commercial paper for construction financing. New Jersey Transit is applying grant anticipation financing to meet accelerated cash flow requirements. These notes are an advance on future payments which have been earmarked under New Jersey Transit District FTA project Full Funding Grant Agreement and are secured by New Jersey Transit District state funding allocations. BART's commercial paper program will be used to allow the project to enter revenue service by 2001, with Federal FFGA payments continuing through 2005. Unlike New Jersey Transit's financing program which is secured by both the FFGA and the New Jersey Transportation Trust Fund, BART's commercial paper is backed solely by the FFGA commitment of federal funds. Baltimore's project was federally funded with the local share provided from the Maryland Transportation Trust Fund.

3.8 Land Acquisition

Transit projects are often delayed due to land acquisition problems. This history was noted at the outset of the Turnkey Demonstration Program as a key risk factor. The basic mitigation for property risks is for the owner to own or control the parcels required prior to giving Notice to Proceed under the turnkey contract. Alternatively, the owner must accept responsibility for condemnation-related delays or change orders. Los Angeles' project is part of a much larger real estate development. Acquisition of the land and related access rights for tunnels and future fixed guideway transit connections was the product of negotiations between public agencies, the Catellus Corporation (who control much of the adjacent property), and other smaller property holders in the project area.

The Commonwealth of Puerto Rico owns a large section of the Bayamon to Rio Piedras alignment. The corridor was assembled to construct a highway and, aside from displacement of squatters, offered a head-start on project implementation. The Baltimore Central Light Rail Extension project encountered delays attributable to airport site access and BART's funding delays revolved around airport-related financing and access issues. Also, difficulty in acquiring cemetery-owned property, not used for cemetery purposes and until recently deeded for transportation purposes, prompted BART to seek eminent domain authority through the state legislature.

The Hudson-Bergen Light Rail project required acquisition of several key sites for park and ride lots, as well as a maintenance facility. The project applied for, and received authority for advance land acquisition in order to avoid delays and speculation premiums while the final stages of the environmental process were

3.9 *Technology*

One of Congress' goals was to assess the implications of turnkey for the introduction of new technologies. Each of the five demonstration programs has an element of new technology, from materials and design specifications to a formal capacity and technology transfer forum. BART and San Juan Tren Urbano incorporate specifications requiring high levels of technological sophistication. The Baltimore Central Light Rail Extensions turnkey contractor designed and installed pre-cast railroad crossings which will have a longer life cycle, permit future replacement of sections, and reduce ongoing maintenance costs. The Tren Urbano project includes a Technology Sharing Program to develop local expertise in rail systems and related technologies. FTA and the PRDTPW co-sponsored a technology sharing conference in Baltimore in November 1997 to raise the transit industries awareness of professional development and technology sharing. The transit plaza for the Los Angeles Union Station Gateway includes innovative paving materials introduced by the turnkey developer that will better withstand heavy loading from transit buses, as well as reduce future maintenance and periodic replacement costs.

3.10 *Site Control*

Site control is a key determinant of suitability for turnkey, going beyond ownership of the land required. Site control relates to the owner's ability to develop its project without an inordinate degree of outside consensus-building. For example, a public agency may technically own a street or transportation corridor but not effectively control it because utilities, municipalities, and neighboring property owners can impose conditions on initial approvals, as well as instigate changes during construction.

The lower the level of site control, the greater are the owner-borne risks for politics, extraneous requirements, delay, change orders, and cost escalation. BART's example is extreme in that the entire program had been contingent upon reaching agreements with San Francisco International Airport on financing, construction, alignment and functional considerations. The BART project is reported to have required over 300 separate agreements to move into construction.

The Hudson-Bergen Light Rail and San Juan Tren Urbano projects have to contend with the preferences of municipalities, utilities, and neighboring property owners on critical cost allocation, alignment, design, and configuration issues. Also, the Hudson-Bergen project utility costs, finishes, alignment, and environmental mitigation programs are all driven by a political climate which provides little site control.

The Los Angeles MTA partnered with Catellus Corporation to build its project. As a result of the joint venture structure and the mutual benefits being derived, the land use approvals secured for site, and confinement of the project to a single location (unlike a rail corridor that winds through miles of neighborhoods and commercial districts), the Union Station Gateway Terminal was assured of a high degree of site control.

The Baltimore Central Light Rail Extensions project was complicated by the diversity of sites in the three extensions, an interface with the Baltimore-Washington International Airport, force account work by Amtrak, and the need to span a major highway facility to reach Pennsylvania Station.

4.0 LESSONS LEARNED AND OUTSTANDING ISSUES

At the time this report is being prepared, the Los Angeles Union Station Gateway and Baltimore Central Light Rail Extensions have been completed. The New Jersey Hudson-Bergen Light Rail, San Francisco BART Airport Extension and San Juan Tren Urbano projects are advancing. As a result, many of the observations in this section pertain to the procurement and program management process. Formal evaluation results will be developed under the Turnkey Evaluation Guidelines as all of the projects move further toward completion.

4.1 *Procurement Strategy and Contracts*

Two-step procurements were undertaken in all five demonstration projects, with San Juan and New Jersey basing their final selection on price and other factors. The turnkey process has predictably reduced the number of contracts let by the owner agencies and increased their total value. For example, Baltimore's Phase I expansion was implemented conventionally and required 37 contracts, compared to three contracts under the turnkey Phase II Extensions. Similarly, the BART demonstration project will entail seven contracts, in contrast to 49 for the similarly priced East Bay Extensions.

A concern that has been raised in industry forums regarding these larger contract sizes is their potential to limit the ability of small and medium-sized firms to participate in turnkey procurements. However, as will be described in Section 4.3, adequate protection has been built into the turnkey process in all cases to assure that work is well distributed throughout the contractor community.

4.2 *Project Management and Control*

The turnkey projects currently underway in the United States do not demonstrate a uniform approach to project management organization. Project management is the responsibility of the owner(s), turnkey contractor team(s), general engineering and management consultants, and potentially other specialty consultants to the owner. The lack of a standard or consistent approach to project management control within the turnkey environment appears to indicate that the project management approach for a project is not a sole result of the influence of the turnkey contract. Instead, the level of project management may result from a variety of influences, including:

- *Type of Turnkey Contract* - A high level of project management control is evident when projects include either a wider range of developmental functions, or an extended implementation time period, or both. For example, the San Juan Tren Urbano project is a modified DBOM contract, with the owner retaining a high degree of project control compared to a conventional procurement.
- *Size and Scope of Project* - More complex projects require a higher level of project control. Projects of a smaller scale or complexity are better candidates for a lower level of project control. For example, Tren Urbano and New Jersey Hudson-Bergen projects involve design, supply, and implementation of systems elements and some or all of the civil elements, increasing complexity, cost, and project management required. The Baltimore Central Light Rail Extensions project exclude vehicle and fare collection systems and rely on the extension of existing, in-place systems technology and design, which contribute toward a reduction in the level of project management control required.
- *Right-of-Way Location* - The alignment characteristics, its full access and ownership, and flexibility for adjustment of the preliminary alignment of a specific section can increase project risk and require enhanced management techniques to overcome them. These techniques are required regardless of the procurement approach used, turnkey or conventional. The Tren Urbano and

Hudson-Bergen projects are being constructed in dense urban areas, with special attention to the surrounding right-of-way location. Each of these projects demonstrates a relatively high level of project management control.

- *Extension or New Start* - Extensions to existing systems often are less complex since they build upon existing well-defined designs and systems technology. New Start projects must address additional complexities of initial systems development, including the potential introduction of proprietary and innovative technology. The initial systems development can result in additional tasks and levels of project development and control. The Hudson-Bergen project, as a new start project, has been initially developed with a mid-level of overall project management reporting control. In contrast, a lower level of project management control is provided for the Baltimore Phase II Extensions than for the initial Phase I project.

The turnkey projects demonstrate a shared approach to project management among the owner, consultants, and turnkey contractor. Owners and their representatives tend to retain a relatively higher level of project management in turnkey procurements than for conventional projects of similar characteristics, particularly for the progress reporting and payment mechanisms. This may be a reaction to the reduced level of detail in the design and construction process.

General Engineering Contractors (GEC), General Management Consultants (GMC), General Management and Architectural and Engineering Consultants (GMAEC), Project Management Oversight Contractors (PMOC) and Financial Management Oversight Contractors (FMOC) all continue to play a key role in the turnkey project development process as liaison between the owner and the turnkey contractor. Each of the turnkey projects, with the exception of the Baltimore Central Light Rail Extensions project, relies on agency contractors to assist with project management and design review functions. This impacts the extent of the overall owner staff effort devoted to project management in turnkey. Based on these preliminary findings and initial review, it appears that the owners have fewer agency staff dedicated to the development and implementation of these turnkey projects. This may indicate a reduced level internal agency developmental staffing sometimes associated with a large-scale transit project. Instead, some of the additional staffing is likely to be diverted to the agency contractor and turnkey contractor organizations, as they are assigned greater responsibility for monitoring implementation.

The San Juan Tren Urbano project represents the initiation of heavy-rail technology and service in Puerto Rico. The Puerto Rico Highway and Transportation Authority (PRHTA) elected to establish an organizational entity within the PRHTA devoted to rail service and known as the Tren Urbano Office (TUO). This office is primarily staffed by the private-sector, including the turnkey contractor and GMAEC staff. This office is aligned with the PRHTA and separated from the existing public bus transit agency which provides Metrobus service. This organizational structure represents a strong reliance on turnkey contractor staff for rail operations, with strategic introduction of local staff through an innovative technology transfer program.

While turnkey contractors demonstrate an increased role, individual responsibility may vary depending on the needs of the particular project or organizational structure for participants. The turnkey projects all provide the turnkey contractors with added responsibility for development and implementation roles for the projects, such as in the conduct of the Quality Assurance/Quality Control (QA/QC) program and plan. Contractors also appear to have assumed expanded and wider responsibilities for development and implementation of systems integration and configuration control mechanisms, in the pre-revenue start-up testing, and in the fulfillment of the safety certification program.

As turnkey contractors assume these increased responsibilities, they must be equipped with the technical knowledge required for successful project management implementation. As the Baltimore Central Light

Rail Extensions turnkey experience indicates, it is helpful for contractors to be familiar with construction management and systems integration functions, including schedule management requirements, configuration control mechanisms and quality control programs. Clear understanding of the individual contractor and agency roles and responsibilities is a joint responsibility of all organizations to ensure that project management functions are implemented and maintained throughout project development.

BART's Airport Extension is a design/build contract with functional separation of the civil and systems components, some contractual separation of the alignment and stations sections, and the complete separation of the construction management function. These project management reporting efforts, both owner-directed and contractor-based, are planned to a high level and to a similar design and degree as Tren Urbano. The main difference between the Tren Urbano and BART Airport Extension turnkey projects is the greater role of the owner agency in the oversight and coordination of the multiple contractors. BART is taking a larger role in the direct coordination of the multiple contract organizations. The Hudson-Bergen project has a slightly lower level of project management reporting efforts and has shifted some of that to an agency contractor. The Baltimore Central Light Rail Extensions project is intended to reduce the owner project management role and reporting oversight in total, particularly for the owner agency staff. However, Baltimore expanded the original project management role with the hiring of a specialty contractor just for that function. The relatively higher level of project management control for each of these projects is, based on initial review, concentrated more within the reporting systems and less in the ongoing management type functions.

4.2.1 Implementing Project Management Control Functions

Project management control functions include proposal evaluation standards, communication basis of project objectives, budget and cost management, schedule management, performance criteria, effective and efficient resource allocation, progress payment mechanisms, claims and change order pricing basis, technical and scope (configuration) control, and quality assurance/quality control. Turnkey contractors have assumed a higher level of responsibility for these functions, but owner agencies and their direct contractors still provide a continuing level of control. The new and unique aspects of turnkey contracting actually may require additional levels of reporting or increased levels of detail on the part of the contractor and a more thorough review and monitoring by the owner. Lessons learned regarding specific project control functions are outlined below.

- Contractors assume some added responsibility for schedule management and cost control under turnkey, but owners tend to retain a higher level of systems control and information visibility over these functions as compared to other project management functions. The Tren Urbano project's extensive use of cost-loaded scheduling and those proposed for BART reflects this approach.
- Combining schedule management, progress payments, and cost control through the cost-loaded schedule process as adopted by the Tren Urbano and BART projects can provide owners with a higher level of project monitoring while streamlining the overall project management process. The San Juan project requirement of combining payment applications with schedule and cost updates is an example of one of the benefits to this combined approach.
- Most agencies rely on monthly progress payments. In some cases it may be necessary to shorten the payment timetable to accommodate concerns from local subcontractors regarding payment. BART's use of semi-monthly payments for the San Francisco International Airport Extension was implemented in part to address this concern and thereby increase the role of subcontractors.
- The owner and contractor must carefully define the QA/QC program, including roles and responsibilities within the bid documents, to avoid communication problems during the course of the project. The Baltimore Central Light Rail Extensions project assigned both

the quality assurance and quality control functions to a separate and distinct contractor within the turnkey contractor team, which was new to both the owner and the contractor. The Baltimore project demonstrated initial confusion over roles and responsibilities between the owner and the contractor, including the contractor's unfamiliarity with some construction management functions. Additional effort was required by the owner to ensure that the contractor implemented the QA/QC program, as contractually defined, once the project was underway.

- Turnkey contractors should have some review role and likely some oversight authority for the other contractors when the contracts are closely related. This process may follow the review model presented by the Tren Urbano project, where the turnkey contractor is provided parallel design review and construction management oversight for the other, related contractors in conjunction with the owner.
- Turnkey contracts may require that the owner raise the threshold amounts for change orders and claims, requiring each level of senior staff approval so that project staff have necessary authority to maintain the project schedule, advance the project, and make decisions at the appropriate organizational level. Since the overall scope and size of the turnkey contract is larger, the dollar amount of change orders and claims may need to be higher. However, as a percentage of total contract cost, the percentage may be in line with that experienced under a conventional contract.
- Owners should be sensitive to subcontractor and Disadvantaged Business Enterprise (DBE) needs when structuring project control systems and may need to include mechanisms within the turnkey contract to provide review of the turnkey contractor's management of subcontractors and DBE's. For example, the BART project uses the work breakdown structure to organize the schedule and cost control features of the contract, which includes discreet identification of work for which DBE's are designated. DBE contractors will know when the prime contractor is paid for work that includes the DBE work through DBE compliance staff on the contractor's team. In addition, there is clear visibility of the contracted functions to ensure that a distributed DBE role is maintained throughout the skilled and professional functions of the project.

4.2.2 Project Control and Risk Management

The turnkey method implies that the owner will shift a certain portion of risk and responsibility among the various project development participants, but mainly to the contractor. The process of shifting risk from the owner agency to the contractor, referred to as the risk identification and allocation functions, is a procurement function. This section of the chapter considers the relationship of risk management and implementation of the risk management plan to the various project management control functions.⁵

The development of the risk management program influences definition of project management control responsibilities. The risk allocation process identifies specific risks that may be faced during the course of the project and determines the most effective manner in which to assign or allocate them. This process determines whether the risk is assumed by the owner, assumed by the contractor, or shared between the two. Allocating the risk will influence overall project management requirements that relate to risk management. For example, if an owner decides that schedule risk will be shared between the owner and contractor, project management functions related to scheduling must provide a level of control to adequately inform both the owner and contractor and manage this jointly shared responsibility function. If it is decided that the contractor will assume responsibility for design and integration risk, then the contractor may need to be provided with more authority for configuration control and QA/QC project management functions and the owner agency provided with ongoing monitoring functions.

Once the project is underway, project management control systems assist in maintaining the risk management program. Cost control functions may provide a means for the owner and agency to monitor financial risk, especially if some more innovative financing mechanisms are followed as exemplified in the New Jersey Hudson-Bergen project. This project included the option for private sector, contractor financing for varying levels of financial contribution, from managing short term cash flow to financing longer term revenue contributions. The contractor team included this financial risk management capability and made this available to the owner agency throughout project development.

The QA/QC program can assist in managing risk to both the owner and contractor associated with construction performance. Management control systems may also assist in identifying additional risks as the project proceeds and in managing the risks as they are identified. For example, the configuration control process could identify potential systems integration issues that could impact successful project development. Each of these projects have included a substantial configuration control role for the turnkey contractor. These examples demonstrate the key roles that project management control functions and the various systems elements provide in supporting the implementation of the risk management plan.

4.2.3 *Project Control and Financing*

The turnkey project development method provides opportunities for transit properties to explore additional avenues for innovative financing of projects. Turnkey offers alternatives to leverage the use of available public resources, such as bond financing, cash flow management, and facilitated access to public/private revenue opportunities. New Jersey Transit was interested in soliciting alternative funding sources for the Hudson-Bergen project to free up funds for other projects, and bond financing through the turnkey contractor was initially included as a contractor requirement. This was reconsidered when a public financing avenue was identified at a lower financing cost. The contractor financing mechanism may now be more targeted toward the smaller demands of project cash flow financing to ensure project schedule maintenance and limit the impacts of public funding and grants processing uncertainties. Public/private revenue opportunities have not been emphasized in the development of these turnkey projects and, as such, only limited opportunities have been identified to-date. The focus of private sector financing opportunities of these turnkey projects has been on effective project management rather than on leveraging public funds.

As the industry considers turnkey procurements, one point of concern is if a large turnkey contract is able to maintain budgeted levels. The completed Baltimore project demonstrated the ability of a design/build project to stay within estimated budget. The MTA succeeded in leveraging public financing to accelerate developmental schedules for the overall Baltimore system by focusing state funds on Phase I and applying Federal funds to the Phase I vehicles and the overall Phase II project. The MTA accelerated construction of Phase I by relying primarily on state funds for system design and construction, with Federal funds supporting vehicle acquisition under a separate project contract. This allowed MTA to advance the project schedule within the limited Federal levels of support available at that particular time. MTA was then able to fulfill developmental requirements for Phase I and begin construction when most New Start Program Federal funds were already committed elsewhere.

The MTA relied on Federal funds to support 80 percent of Phase II. This overall approach allowed MTA to tap into New Start Federal resources as they were available for the later implementation schedule of Phase II. The MTA as part of the Maryland State Department of Transportation was able to access the flexibility of the State's Transportation Trust Fund for the high priority and substantial non-federal contribution to Phase I. They were then able to internally adjust state transportation priorities to the smaller contribution for the latter time frame of Phase II. In addition, the MTA leveraged the state public funding through contributions from the local jurisdictions of Baltimore City and County and Anne Arundel County for

4.2.4 Project Control and Environmental Management

The ability of the turnkey contractor to address environmental mitigation requirements has been a concern raised under turnkey. It is clear that from a project control perspective the owner agency still retains overall accountability for compliance with environmental management requirements under turnkey. As such, the agency must ensure that it has the proper organization and processes in place to address these concerns regardless of whether the mitigation efforts are assigned to agency or turnkey contractors.

The BART Airport Extension project is incorporating all environmental mitigation requirements into the relevant contract documents. To effectively manage environmental compliance, BART created an Environmental Compliance Unit within its Construction Engineering Department. This unit is responsible for ensuring compliance with environmental requirements, acquiring permits, and continuously coordinating with engineering staff.

The Baltimore Central Light Rail Extensions had to meet different environmental requirements under Phase I and Phase II because funding came from different sources. The Baltimore Phase I project was funded only with state and local funds and, as such, was developed under state environmental regulations. The State of Maryland regulations are similar in depth of issues and mitigation responsibilities. The only noted difference was the perceived shorter implementation time period. Phase II required a federal environmental impact assessment. The completion of this process was concluded before the initiation of the design/build contract and therefore the process had no turnkey-oriented impact upon either of the Phase I or II projects. Also, mitigation measures were minor, included in the design/build contract and overseen by MTA staff to ensure compliance.

4.2.5 Project Control and Community Relations/Public Information

Most major capital construction projects, whether conventional or turnkey, place special emphasis on community relations efforts. Developing strong community support and maintaining effective communication during the course of construction is critical to establishing support of the transit system over time. Transit agencies often require conventional or turnkey contractors to provide community relations functions as part of design and construction efforts. These capabilities need to be included in the requests for proposals and reflected in the turnkey contractor teams formed for a project. For example, BART has contracted with a separate contractor to lead community relations, but has vested community relations supporting responsibilities with the design/build contractor for the San Francisco Airport Extension. This requires the team to have expertise in community relations and public information.

Turnkey presents unique demands for the community relations effort, especially under turnkey procurements where the contractor is also responsible for the operations and maintenance phase. The contractor must consider during the project development phases how community outreach will impact ridership at a later date. The San Juan project requires the contractor to provide a comprehensive community outreach and public information program over the course of the project.

This is especially critical for Tren Urbano, since this project represents a new form of technology to the traveling public. New Jersey Transit initially included ridership revenue incentives in the turnkey contract, but decided to eliminate them upon further discussions with the proposing contractors and internal staff. The major issue was the limited control a contractor has over key variables affecting ridership such as the local economic conditions.

Overall, it appears that the supporting roles being effectively designed and included in the turnkey contracts for these demonstration program projects are appropriate. Some role in the community relations aspects of project development appears to be appropriate for turnkey projects. Whether this role is leading or supporting, to what degree of support, and to which functional aspects of community relations remain

4.3 *Disadvantaged Business Enterprise*

Of particular note is the effort made by the Turnkey Demonstration sites to go the extra step to assure that small and disadvantaged businesses participate in all phases of the transit system delivery, rather than being confined to low skill, low priority tasks. Appendix B shows all of the Disadvantaged/Minority/Women Business Enterprise firms employed by the demonstration projects to date. Both the BART Airport Extension and Los Angeles Union Station Gateway projects required the inclusion of a wide spectrum of firms in project planning, financing, design, engineering, construction, management, and leasing. Los Angeles' established and met or exceeded a goal of 25 percent in the areas of design/architecture, engineering, and construction.

Reporting systems are being enhanced to provide clearer information to the owner on compliance and the turnkey contractor's management of DBE's. An important model is BART's adaptation of the work breakdown structure reporting system to identify work for which DBE's are designated. BART also sought to facilitate the involvement of small and minority businesses through the use of bi-monthly invoicing schedules to accelerate cash flow to its subcontractors. Additional BART provisions include:

- DBE goals for separate categories of work,
- multi-tier subcontracts,
- phased implementation,
- liquidated damages,
- contractor DBE technical staff,
- incremental release of retention,
- mobilization payments,
- prequalification of architectural/engineering firms, and
- no bonding permitted for subcontracts less than \$400,000.

The five demonstration projects all have made serious recognition of small and disadvantaged businesses. As shown in Table 4.1, all the projects have set goals which meet or exceed the 10 percent federal requirement. The two completed projects, the Baltimore Central Light Rail Extensions and Los Angeles Union Station Gateway actually achieved 13 percent and 31 percent levels respectively. In Los Angeles' case, the actual percentage of 31 percent exceeded the goal of 25 percent.

Extraordinary efforts also have been noted among the demonstration sites to keep careful track of DBE compliance. BART, for example, has stipulated payment of liquidated damages for non-attainment of DBE goals in its turnkey contracts.

TABLE 4.1

FTA Turnkey Demonstration Program DBE GOAL/ACCOMPLISHMENT

Demonstration Site	DBE Goal Established	DBE Goal Accomplished
Baltimore	Combined 13.0%	16.7%
San Francisco (BART)	Minority 25.6%	
	Women 6.9%	
Los Angeles	Combined 25.0%	31.0%
New Jersey	Combined 25.0%	
San Juan	Combined 10.0%	

4.4 *Quality Assurance/Quality Control*

Quality Assurance/Quality Control (QA/QC) represents all activities necessary to verify, audit, and evaluate quality. It encompasses such functions as, inspection and testing, quality audits, and prescriptive actions. The QA/QC process is intended to prevent errors from occurring, identify errors quickly if they arise, and identify corrective actions. Under the turnkey method, private contractors have greater responsibility for QA/QC, but varying approaches are being used.

For the Baltimore Central Light Rail Extensions project, it was initially intended that the QA/QC process be undertaken by a subcontractor to the turnkey contractor, with minimal agency involvement. However, as implementation progressed it became necessary for the MTA to play a more direct role in this area. For the Union Station Gateway project, LACMTA hired independent QA/QC contractors to monitor the construction process and report directly to LACMTA's Administrative/Project Control Team. Both BART and San Juan projects have significant owner involvement in monitoring the turnkey contractor's QA/QC efforts through regular surveillance reviews.

BART has developed a QA/QC Program Plan which assigns responsibility for both quality assurance and quality control to the design-build contractors. BART will maintain a QA/QC oversight function. The design-build contractors are required to have a BART-approved QA/QC Plan prior to commencing work. Activities for labor associated with the implementation of a contractor's quality program are required to be at least 2.5 percent of the total contract bid price.

Under the San Juan Tren Urbano project, the Systems and Test Track Turnkey (STTT) contractor and the six Alignment Section Contracts (ASC) contractors were required to submit a QA/QC program plan to the owner for approval. The plan was to be reviewed and updated on a regular basis, and not less than semi-annually. The STTT and ASC contractors were then provided the responsibility to implement the QA/QC Program by the TUO, while retaining high level of control for owner monitoring. Also, the STTT and ASC contractors were each responsible for the quality of their respective work, as well as the work of their respective subcontractors. Direct supervision of one's work by the other was provided, but limited inspection and testing. Only the owner had the contractual authority to take recourse action for each contractor's quality program at any time.

With the STTT contractor has responsibility for systems integration, and GMAEC has responsibility for oversight, this lack of contractual authority for these integration and oversight responsibilities may affect the design consistency and integration efforts in later stages.

4.5 *Risk Management*

Risk allocation occurs during the procurement phase because of its influence on bid prices. The USDOT's Volpe National Transportation System Center identified the 24 risk categories shown in Table 4.2 in its *Turnkey Evaluation Guidelines*.

TABLE 4.2
Types of Transit Project Risk

Risk	Description
1 Political	Collective decision process, agreements among local government agencies, willingness of interest groups to reopen prior decisions, ability of groups to disrupt or impede process; environmental reviews; historic, archeological, and religious sites, and legal challenges to project continuation.
2 Funding	Commitments by public and private participants to provide monetary and in-kind contributions to support the project.
3 Financing	Willingness of financial institutions to lend money based on the opportunity costs of funds and the perceived level of funding commitments, to allow matching of cash flow with expenditures.
4 Right-of-Way (ROW)	Ability to acquire all necessary ROW in sufficient time to avoid delays in design and construction.
5 Speculative effort	Chance that planning and design work undertaken for the purpose of securing funding or contracts will fail to produce the intended results.
6 Bids exceed estimates	Submitted bids exceed cost estimates so that the budget becomes insufficient to accomplish planned construction.
7 Geotechnical	Difference between what is known about subsurface conditions and the actual nature of such conditions (not including utilities).
8 Hazardous materials	Uncovering of unexpected toxic, nuclear, or otherwise hazardous materials during construction that require costly disposal or treatment.
9 Underground utilities	Deviation between stated and actual locations of underground utilities, and the unknown existence of pipes, conduits, etc., that may or may not be obsolete.
10 Inflation	Growth in the general level of prices or relevant components of general prices that are incorrectly forecast or which change so as to substantially alter the relative magnitudes of cost components.
11 Federal, state, and local regulations	Changes in regulations or changes in the legal interpretations of existing regulations that create unanticipated costs, including Buy America, Davis-Bacon, OSHA, DBE, FTA, and state employment regulations.
12 Design and integration; coordination	Possibility that the sub-elements of design or the subsystems of the project will not resolve themselves into a coherent functioning whole.
13 Changed requirements	Changed or unanticipated requirements discovered after the point in the development process when they should have appropriately been incorporated, not elsewhere classified in the list of risks.
14 Construction performance	Hidden defects, covered up without external evidence; skill shortages, labor conflicts.
15 Subsystem test	Possibility that the project facility does not function properly when completed, or fails under stress.
16 System integration test	Possibility that the facility functions properly on its own but not when operated with the larger system of which it is a part.
17 Schedule	Slippage in the schedule that extends the project duration or complicates the coordination among subsystems.
18 Construction safety	Control of workplace hazards to reduce accidents to workers and

TABLE 4.2 (continued)
Types of Transit Project Risk

Risk	Description
19 Site security	Prevention of theft and from sabotage.
20 Acts of God (force majeure)	Earthquake, flood, hurricane, and similar natural catastrophes during construction that can only be mitigated at best.
21 Failure to complete	Contractor fails to produce the facility, or lacks the capacity to finish the job.
22 Seismic	Risk that the facility will be seismically unsafe after constructed or will be damaged or destroyed in an earthquake.
23 Operating	Possibility that the system will not generate adequate capacity, or will otherwise result in unexpected operating costs or conditions.
24 Market (ridership or revenue)	Possibility that the service will not attract sufficient customers at reasonable fares to generate planned revenues (revenue bonds or parking garages); decline in value of revenue source.

In the turnkey demonstration projects, the identification and allocation of risks between the owner and the private contractor has been more explicit than in conventional procurements. The owner agencies all have retained the risk of future ridership and revenues. In addition, all the owners have taken special responsibility in the areas of utilities, permits, remediation of hazardous materials, and the identification of geotechnical conditions.

BART conducted an assessment that identified 45 specific risks associated with the design-build contracting method to determine which participant was best able to handle each of these risks. As a result, BART is responsible for receiving environmental approvals, funding, right-of-way acquisition, the project master schedule, and the negotiation of agreements. Using conventional contracts issued by BART, site preparation and utility relocations will be accomplished in advance of the start of work by the design-build contractors.

BART risk management provisions include stringent contract conditions and specifications. These include the requirement for 100 percent performance bond with a maximum of \$250 million, the stated limit of the surety industry. Only the Line, Trackwork, and Systems Design-Build Contracts, awarded for \$523,797,925, exceeds this limit. BART also budgeted substantial amounts for contingencies. Each design-build contract includes a 12 percent design contingency to cover construction-related cost increases. The project budget also included an \$80 million construction contingency, which is nearly eight percent of total project cost exclusive of financing. Nonetheless, initial bid prices were higher than anticipated and consumed virtually all contingencies. A \$66 million increase in budgeted revenues was required to offset the added costs in March, 1998.

In negotiating its FTA Full Funding Grant Agreement (FFGA), BART proposed a Capital Reserve Account (CAPRA) as a source of funds to offset potential risk factors such as inflation, interest rate, and federal appropriations. Sources of the CAPRA include:

- Surcharge revenues at the Daly City Station.
- Premium fares at the San Francisco International Airport Station.
- Fifty percent of the advertising and concession revenues generated at the San Mateo County BART Stations.

- Fifty percent of possible future revenues from joint development activities and parking charges at the San Mateo County BART Stations.

At this time, about \$22 million of CAPRA funds and bond capacity has been utilized to meet the higher bid prices and also the increased costs caused by delays in Federal appropriations. The San Juan Tren Urbano, New Jersey Hudson-Bergen, and BART Airport Extension projects confronted completion risks in a non-traditional way. With contract packages too high to be fully covered by surety bonds, San Juan, Hudson-Bergen, and BART sought and received balance sheet guarantees from turnkey proposers. A major risk that has appeared for both BART and San Juan Tren Urbano is a potentially growing gap between Federal funds anticipated in the FFGA and actual Federal earmarks. These appropriations risks could increase costs and threaten the innovative commercial paper program BART has established to advance Federal funds using the FFGA as the sole collateral.

A key risk issue in the Hudson-Bergen project was the requirement that proposers guarantee operating and maintenance costs for fifteen years, subject to adjustment for changes in inflation and quantity of service. New Jersey Transit did not seek any ridership or revenue guarantees from proposers. The agency was unwilling to assume the risk for future cost growth beyond inflation and quantity of service. The 15-year operations and maintenance period was central to the DBOM procurement philosophy⁶ and it was necessary that the major firms who built the system be accountable for the cost guarantee. A combination of surety and corporate guarantees was used by proposers to provide the required operations and maintenance cost guarantees.

There were a number of Performance Bonds for various contracts for the Tren Urbano project. For the STTT Contract, the DBOM contractor was initially required to furnish full cost (100 percent) performance and payment bonds for Fixed Facilities and Systems. However, the Tren Urbano Project Office requested a waiver from FTA that would allow for lower performance and payment bond levels. FTA granted San Juan's request and allowed a decrease in bond levels to an amount not less than 50 percent of the Fixed Price for Fixed Facilities and Systems.

For the Alignment Segment Contracts, each Design/Build contractor was required to furnish a performance bond in an amount not less than 100 percent of the Fixed Price of the segment contract. Each Design/Build contractor was also required to provide full cost (100 percent) payment bond for labor and material for the Fixed Price of the segment contract.

The total capital costs for the Phase I Tren Urbano project over the period of 10 years (from 1996 through 2006) were \$1.11 billion in year expenditure dollars according to the financial plan in the November 1995 Final Environmental Impact Statement (FEIS). This included \$136.7 million in contingency costs, with total San Juan project costs amounting to \$1.25 billion. The principal DBOM contract was originally budgeted at \$406.9 million, or about 33 percent of the total project costs. At the time of execution of the contracts, cost contingencies were established for the DBOM contract and each the five D/B contracts. Cost contingencies for the San Juan project ranged from 7 percent to approximately 13 percent. The estimated percentages varied in magnitude depending on an engineering assessment of risks and potential unforeseen conditions associated with each contract scope. A higher proportional level of cost contingency was allocated for Río Piedras Alignment segment due to the risks associated with underground tunneling activities. These contingency percentages were revised accordingly as work progressed. The total project cost has recently increased to \$1.55 billion due, in part, to the addition of two new stations to the contract (considered as future stations in the FEIS) and other minor alignment changes. The prime DBOM contract is now estimated at \$568.7 million. The actual bid was \$544.2 million, but an owner-initiated change for an

⁶ New Jersey Transit believed the contractors should live with their own product and build life cycle costing directly into the bid structure

increase in the construction management effort of \$24.5 million subsequently occurred.

For the Baltimore Central Light Rail Extensions project, full cost (100 percent) performance and payment bonds were required from the Design/Build contractor. The Design/Build contractor, Whiting-Turner, Inc., was successful in fulfilling both requirements due to the relatively smaller total value of the Baltimore contract as compared with the higher, more typical turnkey contract amounts. The initial total project budget was \$106.3 million. This included \$21.3 million in unallocated contingency costs for future needs, changes, and claims. The design/build contract was lump-sum, with total costs amounting to \$56 million. The contract value increased about \$3.4 million for approved and nearly approved owner-directed change orders. An additional \$2.5 million is budgeted for owner-directed change orders without a negotiated final value. This brings the total contract value to \$61.9 million. The project budget is anticipated to stay within the \$106.3 million current working estimate.

For the Los Angeles Union Station Gateway project, the LACMTA took precautions to ensure that preliminary estimates and bids were not exceeded during the construction phase. A number of instruments were used as checks and balances along each step, to make sure that this perennial problem is not encountered, and where budgets have to be increased beyond originally-anticipated amounts. These included:

- Developer / Contractor Involvement in Preliminary Budget Estimation - RTD/LACMTA budget estimators worked with Catellus (developer /construction manager) and Pankow (builder) to acquire preliminary cost estimates. These budget estimates were then used as a target budget.
- Multiple Contracts - The Gateway Center budget of \$295 million was divided into two distinct contracts - \$145.5 million for Headquarters and \$149.5 million for Transit Center. The total project was then divided into 10 distinct elements. The total contract value was broken into 25 separate addenda, reflecting the incremental stream of annual funds being received. Breaking the project into smaller sub-projects effectively reduced the probability that a single failure will bring down the project.
- Inflation Factors - Inflationary price increases were factored into bid estimates.
- Fixed Price Contract - The construction contract with Pankow Builders was a fixed price.
- Value Engineering - Value Engineering (VE) was to be conducted with each separate contract at 80 percent completion of construction documents.
- Life Cycle Analysis of Major Components - This phase was performed by the project Cost Estimator at 80 percent completion of construction documents and reported to the Construction Manager.
- Minimum three Sealed Bids - A minimum of three sealed bids were required for each separate contract.
- Independent Cost Estimator's Review of Bids - LACMTA retained an independent cost estimator, whose function was to review submitted bids, prepares the bill of quantities, pricing, and conduct VE on a line-by-line item basis.
- Price Negotiation on Component of Contract - Upon receipt of three sealed bids, a team consisting of the LACMTA Contract Administrator, Oversight Review Team, and the project Cost Estimator would convene to review their estimate of the scope of work of each addendum, and ultimately negotiate the fixed price amount of each contract. All fixed price addenda were to be consistent with the previously approved project budget and funding amount submittal on that specific project to be constructed. Continuous negotiations took place to reduce large variances in the price bids.

Cost Estimator's Review of Bids - Estimator based on measurement of detailed quantities from drawings

at conceptual stages, schematic, and completion of design development stage, followed by estimates at 50 percent and 100 percent completion of construction document. Priced were to be in accordance with the specification and current market condition, based on unit prices or fixed prices, and adjusted according to an agreed-upon price index.

- Board Policy Prohibiting Budget Increases - The LACMTA Board of Directors passed a resolution that the Union Station Gateway project will be a fixed price contract, with no additions to the total budget of \$295 million for the Headquarters/Transit Center, unless the Board changes the scope of the project.

4.6 *Liquidated Damages Provisions, Claims and Change Orders*

In a turnkey process, the risk allocation structure transfers much of the responsibility for changed circumstances to the contractor. As a result, the contractor manages the bulk of the process and only significant items are brought to the owner for approval. By definition, turnkey is anticipated to yield fewer changes because the numerous and complex interfaces among multiple contractors which are associated with conventional procurements are replaced by a single point of responsibility.

Only two projects have progressed to completion thus far and their claims and change order experience are worthy of note. The Los Angeles Union Station Gateway project involved total construction exceeding \$295 million, \$150 million of which was within the scope of the demonstration project, and was completed within budget. Only one minor change order for about \$200,000 was involved. The Baltimore Central Light Rail Phase II Extensions were completed within its \$106.3 million project budget, with \$4.7 million of approved or owner-directed changes. The six changes to date under Baltimore's Phase II compare to 36 changes (30 increases and six decreases) under Phase I which yielded net increases of \$27 million.

The Baltimore Central Light Rail Phase II Extensions project incorporated a number of liquidated damages provisions into their turnkey contract. In the event that the work was not completed as specified in the contract and within 760 days of the Notice to Proceed, the turnkey contractor was to pay MTA a specified amount of fines for each day such completion was delayed. The 760 days for completion of each extension was defined as "completion of all installation, testing, electrification etc. ready for turnover to the MTA for immediate commencement of pre-revenue operations." Fines for each extension were to be assessed in the following manner:

- \$3,350.00 per calendar day for Baltimore-Washington International (BWI) Airport Extension
- \$3,350.00 per calendar day for Hunt Valley Extension
- \$2,900.00 per calendar day for Penn Station Extension

The cumulative daily fine was not to exceed \$9,000.00 as compensation for damages due to loss of revenue, increased administration costs, inconvenience to the public, and impact on other contracts.

There were three minor change orders to the Los Angeles Union Station Gateway project. These were related primarily to the January 17, 1994 earthquake and the ensuing floods in the spring of the same year, just when the steel foundation for the LACMTA headquarters building was being erected and the intermodal transit center underground parking garage was being excavated. The earthquake caused a halt in the construction, while the City of Los Angeles examined and instituted new seismic codes, which necessitated that the reinforcement of the steel girders. Catellus had to hire additional steelworkers, which were scarce following the earthquake, to stiffen the steel structure and redesigned flanges and steel joints with the new stringent seismic requirements. Working with the City of Los Angeles, Catellus hired additional full-time building inspectors, to oversee and check-off work in progress on the reinforcement of the

steel structure of the LACMTA headquarters tower. The Transit Center underground parking garage had to have its concrete foundations redesigned by the Architect/Engineer (A/E) team and reinforced by Pankow Builders. These events caused the change orders that were primarily for the headquarters high rise building as listed below:

- | | |
|-----------------------|-----------|
| • Change Order No. 1. | \$293,000 |
| • Change Order No. 2. | \$124,000 |
| • Change Order No. 3 | \$498,000 |

A key issue for the three more complex projects will be the extent to which these preliminary results are replicated. For the San Juan Tren Urbano project to date, the project budget has increased by \$300 million, or 25 percent since the Full Funding Grant Agreement was signed. While some of the increase is due to scope expansion (an additional station at the University of Puerto Rico, for example), owner-initiated alignment changes (depressing the right of way in several sections), capitalization of initial operating costs, higher-than anticipated costs for tunneling, and expansion of the turnkey contractors Quality Assurance/Quality Control and systems integration responsibilities, the largest single component of the cost change was “System Enhancements and Market Conditions” in the STTT contract for \$94 million. A similar change occurred at BART, where the line, track and systems contract low bid was \$511.5 million compared to the FFGA estimate of \$410 million. The increase was largely attributed to “Changed Market Conditions.”

Liquidated damage provisions are included in the BART Airport Extension design-build contracts. The following are some of the provisions included in the Line, Trackwork, and Systems Contracts:

- For not achieving the 1,380 day completion time - \$165,000 per day.
- For not achieving each of ten separately defined milestones - \$1,800 to \$10,000 per day.
- For delays in passenger revenue service - \$15,000 for the first four hours or part thereof, and \$1,300 per hour thereafter.
- For delays to Passenger Commuter Service under the Peninsula Commute Joint Powers Board - a daily liquidated damage of up to \$20,000 per train for delays of up to 15 minutes depending on the time delayed and whether on a weekday or weekend, and a major liquidated damage of up to \$80,000 per train for delays of more than 15 minutes depending on the number of trains delayed per month.
- For failure to meet any or all of the DBE participation goals or to demonstrate good faith efforts to do so - \$50,000 for each one tenth (0.1%) percentage point below the DBE goals.

The Tren Urbano project set the amount of losses and damages incurred as a result of failure by the contractor(s) to complete all or any designated part of the work within the time period established by the contract, as adjusted by change orders. The established liquidated damages were set as follows:

- \$100,000 per day for each and every day of delay in completing the work after the completion date specified in the contract.
- \$100,000 per day for each and every day of delay, in the event of a termination, such delay to be determined by comparing the progress of the work as of the date of termination against the scheduled progress of the work set forth in the then current detailed Critical Path Method (CPM) schedule.
- \$100,000 per day for each and every day of delay, in the event the contractor failed to undertake

and prosecute extraordinary measures set forth in Article 15.4 of the Contract Documents.

The original New Jersey Hudson-Bergen DBOM contract did not provide for liquidated damages explicitly. Instead, the DBOM contract was structured with a single, bullet payment for the rail cars which was due upon the initiation of revenue service. Since the price for the rail cars was fixed, any delay in either civil, systems, or rail car portions of the project that would delay the start of revenue service triggered substantial interest carrying costs to the contractor. This interest penalty was used in lieu of liquidated damages. Subsequent modifications to the scope and finance structure are altering this arrangement.

4.7 *Time Savings*

According to LACMTA project staff estimates, the Union Station Gateway project was completed in 12 - 15 months less time than a conventional procurement. These time-savings were made possible by developing the project through Union Station Gateway Inc., a non-profit entity serving as the turnkey contractor, comprised of Catellus Development and LACMTA. As a result of this structure, LACMTA's procurement processes did not apply, simplifying project acquisition and shortening the implementation period. Baltimore was delayed due to interfaces with Baltimore-Washington International Airport; however, these are separate and apart from the project scope and the turnkey process. At this stage, it is too early to consider the influence of turnkey on the outcomes of the other three demonstration sites.

4.8 *Industry Involvement and Contract Reviews*

The demonstration projects have all made extensive use of contract reviews and industry involvement processes in order to identify cost drivers, respond to proposer concerns regarding financing, identify the appropriate level of definition to include in the bid documents, clarify roles and responsibilities, and refine the allocation of risks.

4.9 *Value Engineering*

The turnkey demonstration projects have had mixed experience with Value Engineering (VE). While Los Angeles' multi-modal Union Station Gateway realized \$9 million of savings as a result of VE applied to its architectural treatment, BART's VE process yielded \$67 million in potential savings, but only \$5 million were incorporated into the final specifications. BART has included several VE proposals as options in its Line, Trackwork, Systems Design-Build Contract's which can be deducted if bids are higher than the budget. The Tren Urbano project VE initiatives are credited with reducing the costs of fixed facilities, yards, shops, and five stations totaling \$63.3 million in savings, or about 4.0 percent of total project costs. Both Baltimore MTA and LACMTA received improved end-products as a result of material and design innovations adopted by the turnkey contractors. Baltimore's Phase II Light Rail grade-crossings were upgraded with a design that has a longer life expectancy and will be less costly to replace. Los Angeles Union Station Gateway facade treatment incorporated special stone to limit the effects of pollution, while unique brick pavers manufactured in England were used in areas subjected to high volumes of bus traffic because of their durability and ease of replacement.

4.10 *Dispute Resolution Practices*

All of the turnkey demonstration projects have instituted comprehensive dispute resolution processes. For example, BART and Los Angeles have established Dispute Resolution Boards. The BART and Hudson-Bergen Alternative Dispute Resolution process will incorporate the use of Escrowed Bid Documents.

In its efforts to foster cooperation and an effective working relationship among the participants, the Tren Urbano project required that all parties actively participate in 'Partnering' techniques. The Tren Urbano project also delineated that all disputes arising under this contract, which were not disposed of by

agreement or “Final Determination” issued by the Contracting Officer, should be decided by a three-member Dispute Review Board (DRB). Further, the dispute could be referred to mediation by the mutual agreement of the contractor and San Juan. However, referral must be done prior to the issuance of findings and recommendations by the DRB. The San Juan project and the contractor would equally share the mediation or other alternative dispute resolution expenses.

The Baltimore Central Light Rail Extensions Phase II contract was subject to provisions of Title 15, Subtitle 2, State Finance and Procurement Article (Dispute Resolution) of the Annotated Code of Maryland and Code of Maryland Regulations (COMAR) provided by the Maryland Department of Transportation (MDOT). MTA delineated that all disputes arising under this contract, which were not disposed of by agreement were to be decided by the Contracting Officer. Appeals could then be made by Contractor to the MTA Contract Appeals Committee. No special dispute resolution practices, such as arbitration, were called for under this contract.

4.11 Cost Control

All BART Airport Extension design-build contracts will be a combination of lump sum, unit price, and allowance items. Lump sum items will be paid based on the Cost -Loaded Milestone Summary Schedule and Cash Flow Payment Curve. Unit prices have been used for items for which the number of units is uncertain, but can be easily measured. They will be compensated based on field measurements by the District Representative. Allowances have been included for certain incentive and penalty items, and for elements of work for which quantities are uncertain, such as for the Disputes Review Board. Most allowances will be compensated based on the Force Account Daily Report. Payment will be made to contractors twice monthly. All contractor requirements have been rigidly defined in the contract documents, including scope of work, deliverables, and procedures for changes and dispute resolution. Contractors are required to maintain a Job Cost Accounting System to adequately capture the costs necessary to demonstrate entitlement under various remedy-granting clauses of the contract.

As an element of its cost control strategy, BART used a bidding approach that included “additive options.” Due to construction market conditions in the San Francisco area, BART requested two alternative bids to deal with potentially high bids on its Line Contract, the largest of the design-build contracts. The bid request for Alternative One consisted of the minimum work scope needed to complete the project plus ten additive options, with BART reserving the right to select which of these options would be included in the contract. The bid request for Alternative Two included only the minimum work scope needed to complete the project. The use of alternative bids and additive options gave BART the flexibility to adjust project scope and cost in response to bid levels within a finite budget. Scope adjustments without bid options could result in project delay through a rebid process or cost increases through additive or deductive change orders.

The low bid for Line Contract Alternative One was \$523,797,925 and \$499,430,925 for Alternative Two, both in excess of BART’s \$410,000,000 budget for this contract. BART chose to award the contract for Alternative One. To finance these costs, BART applied its construction contingency to this contract and is increasing its budget with funds from the state of California. Although BART chose not to reduce contract scope to control costs, the use of alternative bids with additive options gave BART an additional tool to control costs in an uncertain construction market.

The San Juan Tren Urbano project links cost control to the cost-loaded schedule method. The contract budget is established vis-à-vis the cost and resource-loaded summary schedule. Monthly updates at a more detailed level provide cost and cash management control for the owner since contractors must submit a revised schedule of values for each task. This level of detail appears appropriate for the San Juan project, given the complexity of the relations among the STTT contract and the separate six alignment segment

increases in advance of occurrence.

It is too early to assess the full effectiveness of this cost control approach, since initial observations indicate some contractors have not been able to maintain the cost control process. The current budget for the Tren Urbano project Phase I has been increased to \$1.55 billion, compared to the previous estimate of \$1.25 billion. These budget changes have been mainly the result of revisions to the project scope. The addition of two new stations to the contract (considered as future stations in the FEIS), minor alignment changes, and increased construction management oversight account for the majority of the added costs.

Responsibility for cost control in the Baltimore Central Light Rail Phase II Extensions project was shared between the owner agency and the design/build contractor. The owner developed the overall project financial plan and provided ongoing monitoring of contractors budgets and actual expenditures. The design/build contractor was required to provide staff to monitor, control and report actual design and construction costs of its contract.

This type of approach appears to have been effective for a relatively smaller size project such as Baltimore. The design/build contract and overall project are expected to be completed within budget, with the largest portion of the design/build contract completed, the budget appears likely to stay within the \$106.3 million current working estimate.

Several budget revisions for the Baltimore project were required to reflect both schedule and scope changes. The Hunt Valley Extension alignment was measurably altered. Hunt Valley right-of-way (ROW) was delayed into the contractor's access time period. Completion of the Baltimore/Washington International Airport (BWI) Extension was delayed due to construction delays of the Airport Terminal, consequently delaying the opening of BWI and Penn Station Extensions for revenue service. Particular contract items and roles necessary to complete the project were omitted from original contract scope and appended subsequently. These schedule and scope changes were all managed within the total contract value authorization and implemented in the change order process. These delays, also, resulted in increased cost to the MTA which partially resulted from hiring and training of the operation staff in anticipation of the original opening dates.

The Hudson-Bergen project DBOM structure places the burden for cost control on the contractor. It was planned that the initial pricing would be influenced by minimizing the number of required drawings the proposers would have to accept and granting the proposers broader flexibility in materials and techniques. However, the advanced stage of design for much of the project as bid precluded significant cost saving innovations. Moreover, significant schedule and scope changes have occurred since award of the contract which have made comparisons between initial bid price and final delivered costs very difficult, if not impossible.

4.12 *Schedule Management*

The management of time is crucial to the successful completion of a project. The Turnkey Demonstration projects employed several schedule management techniques. While BART is responsible for the overall program master schedule, each design-build contractor is responsible for scheduling their contract activities within the constraints imposed by BART. Schedules to be provided to BART by the design-build contractors include the Milestone Summary Schedule, Detailed Project Schedule, Update Schedule, and Two-Week Look-Ahead Schedule. Very precise requirements are included in the contract documents for maintaining and reporting schedules. The Milestone Summary Schedule and the DBE Detailed Project Schedules are required to have all activities cost-loaded to support payment and DBE participation verification.

The San Juan Tren Urbano project schedule management system is based upon the cost-loaded schedule

method. The STTT contractor and the ASC contractors submit cost-loaded schedules to a Level 4 degree of detail as part of their proposals to the owner. This level of detail represents the contract schedule and contract budget. Once the contract is awarded, the contractors submit a more detailed schedule (to a Level 6 degree of detail). This level of detail drives the progress payment and cost control functions.

The STTT and ASC contractors are responsible for maintaining their respective schedules, with a high level of informational review provided by the owner and the owners GMAEC consultants. Contractors are required to submit monthly schedule updates to the owner, which are tied to the payment to the contractor. The relationship of combining payment and scheduling provides a consistent reporting framework for progress monitoring and reporting and an important incentive for the contractor to stay up-to-date on scheduling and progress reporting requirements. In addition, the detailed nature of the cost-loaded scheduling approach provides the owner with an effective tool to monitor specific progress of key tasks on the critical path without the necessary expense of extensive field staff.

It is still too early in the project cycle to develop any firm conclusions regarding the success of San Juan's approach to schedule management. Further review of actual schedule adherence by the STTT and ASC contractors will assist in identifying specific lessons learned. In general, it appears that the cost-loaded schedule approach offers the turnkey contractor specific guidance in fulfilling schedule management requirements while giving the owner the information it needs to ensure the project stays on schedule, and within budget.

Schedule management was a significant issue during the early portion of the Baltimore Central Light Rail Phase II Extensions project. The design/build contractor was not required to submit a significantly detailed schedule with the proposal but instead, was required to develop the schedule after the contract was awarded. The contractor's baseline schedule was submitted late and modifications by MTA were not incorporated in a timely fashion. The contractor did not initially appear to view schedule-based reporting as an important aspect of contract terms.

The MTA formalized project schedule submittal requirements of the contractor after some initial problems, requiring monthly updates with narratives on impacts of any schedule changes. The MTA also added a specialty contractor to assist MTA staff with schedule issues, which provided numerous benefits. MTA had increased visibility over individual task completion, and was better able to be actively involved in task-level problem identification and resolution that could have affected the entire project. In one known case before this capability was fully operational, MTA identified a design sub-task behind schedule that could have directly affected the delivery of key systems components.

Baltimore's experience indicates that turnkey may require increased schedule visibility and closer monitoring of project schedule compliance, especially with a contractor unfamiliar with design/build's application to transit. Responsibility for schedule management needs to be firmly established at an early stage of the project, and then followed in conformance with contract terms.

A Master Schedule Program was used for the Gateway Center project, which identified and tracked major accomplishments of various services and implementation of capital project activities, including design, real estate acquisition, funding, local agency activities and construction. Detailed project activities were identified and tracked separately within each phase based on the Project Master Schedule and updated by the Construction Manager, ensuring that all major tasks, required submittals, and milestones were reflected on the schedule. The Quality Assurance Consultant reviewed and updated this schedule and submitted it to the Union Station Gateway President.

The guiding concept for the Hudson-Bergen project for schedule control was to permit a maximum degree of flexibility for the proposer. The contractor would propose a cost-loaded schedule, but would be free to

accelerate elements, particularly if delays occurred in some areas. The changes in schedule and scope since the contract was signed have made it difficult to create a benchmark for comparison.

4.13 *Introduction of New Technology*

Since no design-build contracts have yet begun on the BART Airport Extension project, there has been no experience on the introduction of new technology due to the use of design-build. Given that BART is an existing operating system with well established specifications, the design-build contractors will be somewhat limited in their ability to introduce new technologies.

The San Juan Tren Urbano project is still in the early construction stages and has only demonstrated limited introduction of new technology. Further lessons learned and observations are expected as the project moves forward.

The Baltimore Central Light Rail Phase II Extensions design/build contractor introduced a new type of pre-fabricated, at-grade rail/roadway crossings that were not specified in the contract. The crossings, designed and installed by the design/build contractor, are functioning well. This pre-fabricated type is an upgrade from the typical MTA design for in-place construction. The contractor's version is expected to have a longer life cycle, the ability to replace sections of the crossing for maintenance and minor damage needs, a reduced replacement cost and construction impact, and an expected longer total asset life than the MTA specified design.

New intelligent transportation systems technology advances that the MTA has specified to be introduced through the project include the installation of traffic signal preferential treatment devices, vehicle location and communication devices, and maintenance diagnostic systems on all of the new light rail cars and the installation of these technologies on all of the existing rail cars. MTA is working with the City of Baltimore and the MDOT to explore and test the initiation of traffic signal preferential treatment devices, especially in downtown Baltimore. Some initial testing issues have been identified, but must be addressed before full implementation.

The 15-year operations and maintenance component of the Hudson-Bergen DBOM procurement was intended to facilitate technology innovation as a means to improve reliability, reduce future operating costs and permit a more competitive bid price. Technological risk would reside with the contractor because the performance requirements would have to be met over the extended operating period. By controlling maintenance, it was felt the bidder also could control warranty issues and reliability more completely. It was strongly believed during the DBOM contract development that building-in greater redundancy or improved diagnostics could yield benefits in terms of reduced fleet size or lower maintenance outlays. It is too early in the course of this project to determine if these beliefs have held true.

4.14 *Operations and Maintenance*

The operations and maintenance phase raises unique issues for the owner agency and turnkey contractor. Given that only the Baltimore Central Light Rail Phase II Extensions and Los Angeles Union Station Gateway projects have entered the operations and maintenance phase, there is not enough information at this time to examine lessons demonstrated from the turnkey projects. However, it is possible to look ahead at the issues that will be encountered both leading up to and during the operation and maintenance phase. Many of these issues are being addressed through turnkey procurements and related contract documentation. Significant issues to consider include how the agency and contractor will comply with Federal guidelines, follow state statutes and local laws, address the impact of inflation on payment, define liability responsibility, and assign organizational roles and responsibilities.

4.14.1 Federal Guidelines

Revisions to the FTA's Third Party Contracting Requirements (FTA Circular 4220.1D), Grant Management Guidelines 1996 Update (FTA Circular 5010.1B) and Project and Construction Management Guidelines - 1996 Update have increased the flexibility of requirements for grantees, with benefits for both turnkey and conventional projects. While the FTA has made substantial revisions to its guidelines, there are still areas that should be considered with relevance to the operations and maintenance phase of turnkey procurements. In particular, agencies are challenged to ensure that the operations and maintenance phase participants follow the Common Grant Rule, adhere to procurement requirements (including contract duration and competition), manage capital grants, provide for continuing control of assets, and meet system safety requirements.

One way to ensure that Federal requirements are followed during the operations and maintenance phase is to include them in the procurement documents. Identifying and explaining specific Federal requirements up-front provides both owner agencies and contractors with an understanding of the key issues to be followed. Both the New Jersey Hudson-Bergen Light Rail and the San Juan Tren Urbano procurement documents include clauses requiring compliance with Federal guidelines and defining specific requirements of the guidelines.

While the owner agency can assign responsibility for these areas to the contractor, the owner agency still retains overall responsibility for ensuring compliance with Federal guidelines. As such, it needs to develop processes to monitor execution by the contractor. The procurement documents often indicate how compliance with the guidelines will be implemented, assign responsibility to the owner agency or contractor, and include processes for monitoring compliance. For example, the San Juan procurement documents require an annual inventory of assets to be submitted with the contractor's annual report - an effort that assists in maintaining continuing control of assets. The actual success of strategies to monitor compliance will need to be observed as the projects enter the operations and maintenance phase.

4.14.2 State Statutes and Local Laws

States and localities have unique statutes and ordinances beyond Federal guidelines that apply to public agencies, including transit agencies. Some of these laws may address areas such as competitive procurement, environmental compliance, use of state and local funds, and labor practices. States and localities also may have certain permitting processes that are required to be followed over the course of the operations and maintenance phase.

Owner agencies are challenged to ensure that turnkey contractors follow these statutes and laws under the operations and maintenance phase. As with Federal issues, turnkey procurements have attempted to identify these requirements and assign responsibility among owner agencies and contractors. For example, the San Juan Tren Urbano contract includes language that requires the contractor to follow laws, regulations, codes, executive orders, and other orders of the Commonwealth of Puerto Rico and related municipalities. Tren Urbano also specifically assigns responsibility for obtaining all necessary permits to the contractor. Again, the actual implementation and monitoring of compliance with these state and local requirements is a point to be observed as the projects enter the operations and maintenance phase.

4.14.3 Inflation Impact

The turnkey procurements that include operating and maintenance responsibilities present a challenge in determining how to compensate contractors for operations services to be provided in future years. Bids for these contracts are often prepared years in advance of when the operations and maintenance phase will

commence. The San Juan Tren Urbano proposals were received in 1996, for instance, but operations will not begin until 2001. Both the agency and contractor have a vested interest in assuring that the agreed-upon contract and price for operations and maintenance accurately accounts for the future value of goods and services and considers the impacts of inflation.

Agencies have attempted to address this issue by allowing contractors to compete on a base-line price with a pre-agreed built-in escalation index common for all contractors. The Hudson-Bergen contract establishes an annual fixed-price for the operations and maintenance phase subject to economic price adjustments as outlined in the contract. On each anniversary date of the operations and maintenance contract, the fixed-price is adjusted by multiplying the annual amount by the factor appropriate to the current-month index. Tren Urbano follows a similar approach. The contract indicates the agency will pay the contractor the base compensation for the service year specified in the compensation schedule. This base is adjusted for cost inflation according to separate indices for labor, materials, and other cost as outlined in the contract. Tren Urbano's contract also contains provisions for performance compensation adjustments for categories such as: on-time performance, missed trips, vehicle accidents, quality of maintenance, and ridership.

4.14.4 Liability

The assignment of liability during the operations and maintenance phase is another issue that must be considered. The agency often owns the assets being used by the contractor, raising an interesting concern as to who is responsible for any form of public liability. Again, this issue is generally considered up-front through development of the turnkey contract documents. The San Juan project attempts to allocate risk and liability for operations to the contractor for "performance of the services and use and occupancy of the service property." An indemnification clause also is included in the San Juan contract whereby the contractor agrees to indemnify the owner against all claims, losses, or liabilities.

The New Jersey Hudson-Bergen project also assigns liability for operations and maintenance to the turnkey contractor. The contractor is required to procure and maintain liability insurance during the entire phase. This insurance is to cover the contractor, owner, and respective members against claims. Note that these are the provisions agreed to in the turnkey contract documents. Additional issues related to the operations and maintenance functions are expected to arise as the turnkey projects move into full operations and maintenance.

4.14.5 Organizational Structure

Turnkey offers the opportunity to rely on the private sector to supplement the operational skill base or staff level of an existing public agency. Roles and responsibilities for transit operations and maintenance traditionally carried out by the public agency are often assigned to the turnkey contractor under new start turnkey procurements. This approach may be especially useful for agencies which are implementing a new form of transit service and lack the existing organization or skill base to initiate it. An inherent goal may be to rely on outsourced expertise to handle the first several years of operations and maintenance, develop the capability locally through technology transfer, and consider transferring to public operations in the future.

There are several strategies under turnkey that can be followed to provide accountability and definition to the operations and maintenance organizational requirements. The San Juan Tren Urbano contract requires the turnkey contractor to outline its organizational structure for operations, including roles and responsibilities of staff, in the Operations and Maintenance Procedures. This organizational structure must be approved by the PRHTA and is then incorporated into the overall contract. In addition, the PRHTA has the right to review and approve the hiring of key personnel — another feature which can lend a level of oversight by the owner agency.

by the public agency than a private consortium. Turnkey can provide flexibility through the defined organizational structure to accommodate these concerns. For example, the San Juan project requires the turnkey contractor to provide security personnel along the transit system. However, the owner agency (PRHTA) is responsible for arranging for police officers with arrest powers to patrol stations and revenue service trains.

Of particular interest to the organizational structure is the process for revenue collection and distribution. The New Jersey Hudson-Bergen project assigns responsibility for these functions to the owner agency. The owner is to operate and maintain all fare collection equipment and is responsible for all revenue, ticket stock, pass control, collection, and accounting. The owner will also collect parking fees and maintains parking fee collection equipment. Conversely, San Juan Tren Urbano will vest responsibility for fare collection with the turnkey contractor. The contractor is responsible for storage and security of ticket stock, collection of fares, handling security of deposits, and counting and depositing receipts.

Actual implementation of key organizational issues identified should be observed as projects approach and enter into the operations and maintenance phase. Once operations is underway, it will facilitate documenting additional lessons learned as related to this component of turnkey procurements.

5.0 CONCLUSION

The transportation industry is taking notice of the benefits of the turnkey approach to infrastructure project delivery as reflected in the growth of its use and of industry dialogue since ISTEA. The changing direction of mass transit project delivery practices is being stimulated by five demonstration projects FTA is sponsoring under the Turnkey Demonstration Program (Section 3019). These projects emerged from a comprehensive industry review process that triggered 17 requests for designation. The legislation required that FTA approve no fewer than two projects to demonstrate turnkey procurement practices in an effort to “advance new technologies and lower the cost of constructing new transit systems.”

A turnkey system undertaking was defined by Congress as “a project under which a recipient contracts with a consortium of firms, individual firms, or a vendor to build a transit system that meets specific performance criteria and which is operated by the vendor for a period of time.” Also, Congress permitted contract awards for turnkey-type procurements to be made to other than the lowest bidder when such an award leads to reduced long-term costs.

This Status Report provides Congress with an update on the progress being made in implementing the Turnkey Demonstration Program. The underlying benefits of turnkey include:

- expedited procurement,
- improved risk allocation,
- encouraged applications of new technology,
- promoted accountability through a single point of contact,
- accelerated schedules for project delivery,
- reduced costly change orders,
- facilitated partnering,
- strengthened program management,
- facilitated opportunities for innovative finance and,
- secured bids based upon factors other than lowest price.

These benefits have caused a shift in implementation philosophy among public agencies, as well as architecture and engineering firms, heavy civil constructors, vehicle manufacturers and systems suppliers. In the majority of cases, initial experiments with turnkey methods have had to overcome hurdles beyond the anticipated inertia which typically confronts any effort to modify traditional practices. Many state statutes and administrative procedures complicate the acquisition of design services and construction through a single contract, limit pre-qualification, a necessity of turnkey procurement, and require acceptance of low bid construction proposals. These barriers to broader applications of turnkey are falling rapidly. At this time, 21 states have favorable legal environments for turnkey, with most adopting revised procedures within the past three to five years. The good news is that the Federal government has taken a leadership role in promoting the use of turnkey through the Federal Acquisition Reform Act of 1996.

The five FTA sponsored demonstration sites include two projects which are complete — The Los Angeles Union Station Gateway Terminal and Baltimore’s Central Light Rail Phase II Extensions. Both projects represented time savings of at least one year over conventional methods, with final costs at or below budget and very limited change orders. In the case of Los Angeles Union Station Gateway, important joint development opportunities also were realized. Both sites have applications of new material technologies introduced by turnkey contractors that will lower future maintenance outlays and

While the BART Airport Extension is just moving forward under a Full Funding Grant Agreement at this time, an enormous benefit in project implementation was realized through special state legislation which permitted BART to pre-qualify proposers. Both the New Jersey Hudson-Bergen and San Juan Tren Urbano projects successfully completed complex procurements for the turnkey delivery of complete New Start Rail systems in heavily urbanized areas. These two sites will also address Congress' goal of testing the benefits of having the turnkey contractor deliver operations and maintenance services. The New Jersey Hudson-Bergen Light Rail project succeeded in attracting innovative financing proposals for several hundred million dollars of civil construction and rail car acquisitions. At the same time, a caution flag must be raised in regards to costs. The New Jersey Hudson-Bergen DBOM contract was awarded prior to establishment of the FFGA budget. It appears that the low-bid was above planning estimates. Both the BART Airport Extension and San Juan Tren Urbano bid prices exceeded planning estimates. There also appears to be an emerging risk regarding funding availability and timing of Federal appropriations, which can adversely affect cash flow projections and the ability to continue work. A real test of the turnkey method will be to determine if these higher initial bids result in lower rates of cost growth as construction progresses.

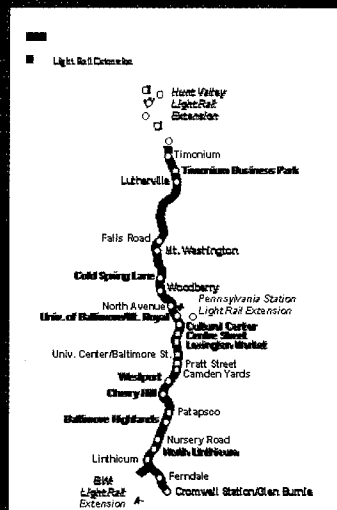
FTA has actively engaged all sectors of the transportation industry in implementing the Turnkey Demonstration Program, carefully monitored and documented the progress of the demonstration projects, disseminating information about these experiences nationally and internationally, and kept abreast of highway developments. The body of experience and lessons learned is growing rapidly, permitting the turnkey delivery method to undergo constant refinement and adaptation to the challenging environment of mass transportation construction.

APPENDIX A

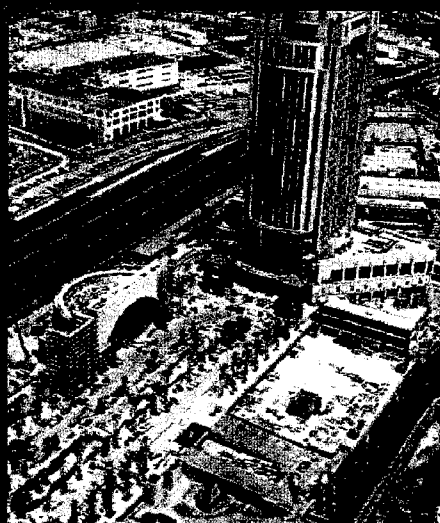
Graphics of the Five Turnkey Demonstration Projects



BALTIMORE MTA CENTRAL LIGHT RAIL LINE EXTENSIONS

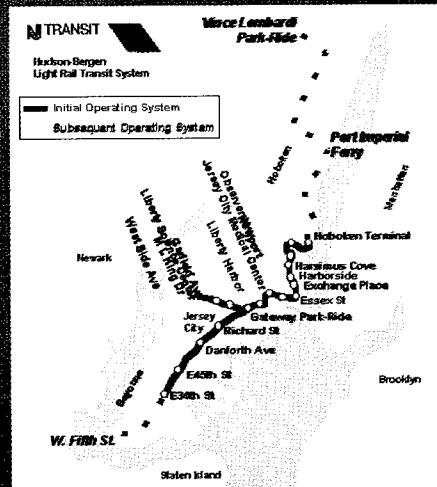


LOS ANGELES MTA UNION STATION GATEWAY

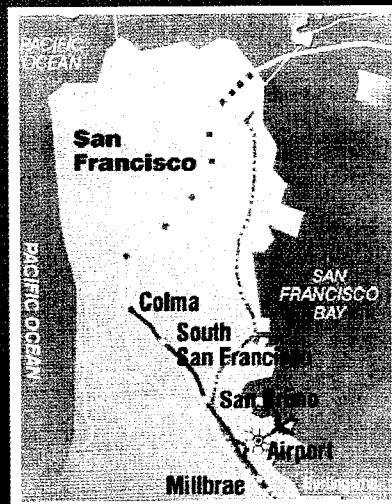




NEW JERSEY TRANSIT HUDSON-BERGEN LIGHT RAIL TRANSIT PROJECT

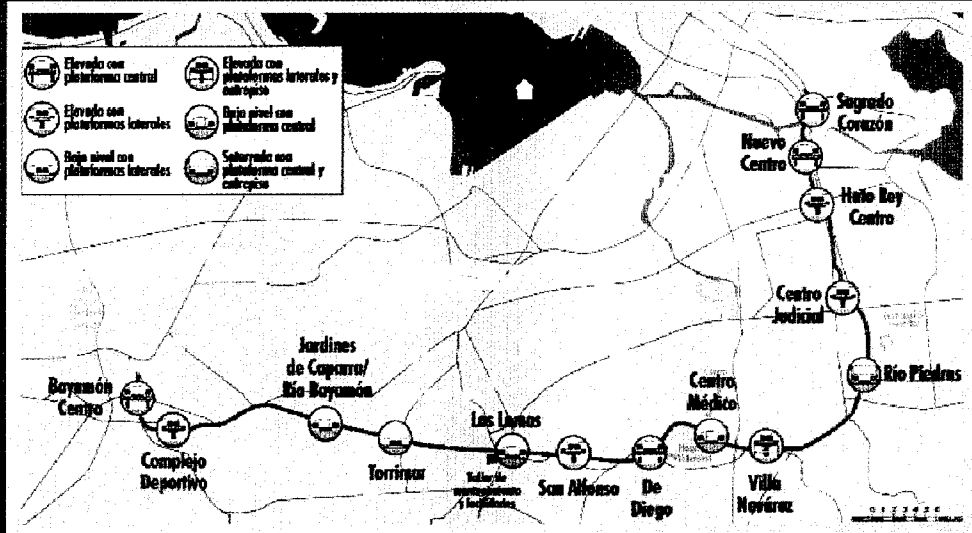


BART AIRPORT EXTENSION





SAN JUAN TREN URBANO



APPENDIX B

Primary Members of the Contracting Teams, including DBE Contractors

BALTIMORE PHASE II CENTRAL LIGHT RAIL LINE EXTENSIONS

The following is a list of the team compositions under the Design/Build contract:

Whiting-Turner Contracting Company Design/Build Team

- Whitney, Baily, Cox and Magnani (Lead Designers)
- TO Dyer (Track Designer)
- HNTB (Structural / Civil)
- Electrack (Systems/Catenary/Traction power)

Minority Business Enterprise (MBE/WBE) Firms

- **MBEs**
 - Cotton Construction Co., Inc., MD
 - Machado Construction, MD
 - AJAC Contracting, MD
 - Sidhu Associates, Inc., MD
 - M & T Electric, DC
 - K - O Construction, Inc., MD
- **WBEs**
 - Norge Erosion Control, MD
 - Priceless Industries, MD
 - Gould Architects, P.A., MD
 - Robert Balter Company, MD
 - Guardrails, Etc., MD

SAN JUAN TREN URBANO

STTT Contract (The Siemens Design/Build Team Composition)

Principals

Siemens Transportation Systems, Inc.	(Contractor)
Alternative Concepts, Inc.	(ACI)
Juan R. Requena Associates	(Designer)

Subconsultant Designers

- Guillermetry, Ortiz and Associates
- URS Greiner, Inc.
- Wallace, Floyd and Associates
- Sierra Cardona Ferrer
- J. Ledón and Associates

Subcontractors - Fixed Facilities

• Redondo/Perini JV	(Construction)
• Delta Consulting	(QC)
• Hormigonera Mayaquezana, Inc.	(Batch Plant)
• Continental Lord	
• Redondo Precast Plant	

Subcontractors - Systems

• Parsons Brinckerhoff	(Trackwork, Power)
• Lord-Mass JV	(Communications, System Inst.)
• MATRA	(Train Control)
• Railquip	(Electro/Mechanical)
• Siemens TS3	(Power Supply)
• Siemens TS5	(Vehicles)
• Siemens TS2	(OCC)

BAYAMON Alignment Section Team Compositions

Principals

• ICA	
• Miramar Construction	
• Taller Borinquen	(Designer)

Subconsultant Designers

- Stone and Webster
- López and Grillasca
- Manuel A. Quilichini, P.E.
- Omega Engineering

Subconsultant - Fixed Facilities

- | | |
|---------------------------------|--------------------------------|
| • Suelos Engineering | (Soil & Concrete Testing) |
| • Freyssinet | (Alignment & Precast Segment) |
| • Hormigonera Mayaquezana, Inc. | (Batch Plant) |
| • GMTS | (Welding & Rebar Testing) |
| • Vivoni, Vlliegas & Associates | (QC Inspection) |

RIO BAYAMON, CENTRO MEDICO, and VILLA NEVAREZ Alignment Section Team Compositions

Principals

- | | |
|------------------------|------------|
| • Redondo/Entercanales | |
| • H2A | (Designer) |

Subconsultant Designers

- Behar-Ibarra Y Associates
- Sierra Cardona Ferrer
- William Reichard, P.E.
- Leonardo Vidal, P.E.
- JIMI Engineering, Inc.
- Antonio Melendez & Associates
- Vega & Mendoza
- Iberinsa
- Terravac
- GEOSIM
- GEOCONSULT

Subcontractors - Fixed Facilities

- | | |
|--------------------------------|---------------|
| • Hormigonera Mayaquezna, Inc. | (Batch Plant) |
| • Lord Electric | |
| • Hill Construction | |
| • Better Roads | |
| • Atlantic Pipe | |
| • Continental Engineering | |
| • Miguel P. Velez & Associates | (QC) |

RIO PIEDRAS Alignment Section Team Compositions

Principals

KKZ (Kiewit, Kenny and Zachry)

CMA Architects & Engineers

Subconsultant Designers

- Sverdrup Civil, Inc
- Jacobs Associates
- Woodward-Clyde Consultants
- Bermudez & Longo, S.E.
- Anil Verma Associates, Inc.
- Fluent, Inc.
- Corrotek Corporation
- Acentech
- GEO Engineering, Inc.

Subcontractors - Fixed Facilities

- Environmental Quality Laboratories
- GEOCONSULT, Inc.
- GMTS
- GEO Engineering
- Moretrench American Corporation
- Marmelejo Contractors Inc.
- GEOSIM
- Alonso and Carus
- Concrete & Materials Testing Inc. (CMT)

HATO REY Alignment Section Team Compositions

Principals

- NECSO
- Redondo Construction
- Iberinsa (Designer)

Subconsultant Designers

- Leonardo J. Vidal, P.E.
- Melendez & Associates
- NECSO / Entercañales, S.A.
- J. Mueller International
- Sierra, Cardona, Ferrer
- Arquitectura Langdon, S.A.
- Law Environmental Caribe

Subcontractors - Fixed Facilities

- Caribbean Aerial Surveys, Inc.
- GEOSIM
- Carrillo / Digeronimo (QC)

Minority Business Enterprise (MBE/WBE) Firms

STTT and ASC contractors have submitted, to the TUO, MBE/DBE participation plans. San Juan Tren Urbano Office has since required the contractors to modify their plans, and is currently awaiting responses. As a result, information on MBE/WBE participants is not currently available. However, some of the above listed firms may be MBE/WBE.

LOS ANGELES UNION STATION GATEWAY

Primary Members of Contracting Team

The contracting team consist of professionals with backgrounds in complex mixed-use and transit related projects. They are widely experienced at incorporating state-of-the-art design, engineering, methodology and technology construction. They include:

Firm

Charles Pankow Builders
Ehrenkrantz & Echstut
McLarand, Vasquez & Partners
Mollenhauer, Higashi & Moore
Levine Seegal
Converse Consultants
Korve Engineering
Law / Crandall
Levine-Fricke Engineers
Johnson Controls
Smith Emery
Lehmer Associates
CRSS Constructors
Iskander and Associates
Coopers & Lybrand
Sheppard, Mullin, Richter & Hampton
Demetrian, DelGuercio, Springer & Moyer
O'Melveny & Myers
Jones Day
People Works
Cordoba Corporation
Allied Environmental

Function

Design / Builder Contractor
Architects
Architectural and Planning Services
Civil Engineering
Electrical Engineering
EIR Consultants
Civil / Traffic Engineering and Transportation
Geotechnical Engineering
Soils Analysis
Telecommunication
Testing and Inspection
Sharing Design
Project Monitoring Services
Cost Estimating Services
Financial Advisors
Corporate Counsel
Legal Services
Tax Attorney
Agreements / Negotiations
DBE Outreach / Certification
DBE Monitoring / Reporting
Contaminated Soil

DBE Contractors

An extensive WBE/MBE/DBE program and a goal of 25 percent was established by the Los Angeles County MTA (LACMTA) Board. Each of the turnkey team contractors were required to procure WBE/MBE/DBE contracts as part of their commitment to the project owner (LACMTA). Of the \$278 million design and construction services provided to accomplish the USG Center, by the completion date of the project in the fall of 1995, approximately 120 individual contracts were let utilizing WBE/MBE/DBE firms, totaling \$75.8 million, thus accomplishing almost 30 percent of total contract value. The names of the DBE firms utilized are as follows:

WBE/MBE/DBE utilized by the General Contractor, Charles Pankow Builders, Inc.

Allee	Innovation Systems	Robert W. Kobashigawa
A.S. Vasquez Cosntruction	J Colavin	Robnett Engineering
Borbon	Katz, Okitsu & Associates	Saddleback Irrigation
Brentwood	Key Air Conditioning	Sanders Engineering
Cable Moore	KUMAR	Sakaida Nursery
Cal State Rebar	Laguna's Wrought Iron	Sakaida and Sons
Carrara	Lawrence Trucking	Savala
Commercial Refuse	L&B Electric	Sean Construction/American Stair
Cordova Bolt, Inc.	LCD Construction	Security Fire Protection
Cowelco	Masonry Systems	Sharma
C.L. Concrete	Multitec Pump & Machine	Shamrock Base Corp.
D&N Concrete	M-R Joint Venture	Specialty Installers
Dave Barry	Nature-Gro Corp.	Sullivan Concrete Textures
Davis Blueprint	N.J. Products	Sunglow Electric
Diamond Drilling	D&N	Terra Tech Labs
E&R Electric	Orange Coast Electric Supply	Tri-City's Rebar
ELA Inc.	Orestes Pena Trucking	Van Nuys Sheet Metal Via Cornado
Elevator Extras	Pacific Van Lines	Via Coranado
Empire Maintenance	Pacifica Insultation	Via Park Leasing
Delix/Amelco	Park Steel	WBE Concrete
Foothill Glass	Ponte International	Western Paving
G&C Equipment	Quality Elevator	Westport Development
Giroux	R&R Masonry	Westside Concrete
Harry T. Williams Lumber	Renovations	Zebra Equipment
Honda	REH Trucking	

WBE/MBE/DBE utilized by the Construction Consultant, CRSS, Inc.:

Cordoba

WBE/MBE/DBE utilized by the Contaminated Soil Consultant, Dames & Moore, Inc.:

American Barricade	Estex
Lee & Ro	Environmental Engineering
Spectrum ESI	Environhealth
A.L. Burke	

WBE/MBE/DBE utilized by the Architect,, Ehrenkrantz & Eckstut Architects:

Raw Architecture	Fong & Associates
Martin & Huang	Sussman Prejza
Tsuchiyama & Kaino	Cal. Access Consultants

WBE/MBE/DBE utilized by the Telecommunications consultant, Johnson Controls:

APR Consulting

WBE/MBE/DBE utilized by the Civil Engineer, Korve Engineering:

Inland Aerial Surveys
Linda Pierce
Martin & Huang

WBE/MBE/DBE utilized by the Environmental Engineer, Levine-Fricke Engineers:

Terra Tech Labs, Inc.
United Pumping Service, Inc.

WBE/MBE/DBE utilized by the Architect, McLarand, Vasquez & Partners:

Martin & Huang	ACG Environments
Tsuchiyama & Kaino	MV&P International
Fong & Assoicates	Karen Hill Scott
Sussman/Prejza & Co.	

WBE/MBE/DBE utilized by the Civil Engineer, Mollenhauer, Higashi & Moore:

Inland Aerial Surveys, Inc.
Katz, Okitsu & Associates

WBE/MBE/DBE utilized by the Legal Council, Sheppard, Mullin, Richter & Hampton:

Gomez, Fujioka & Furukawa

WBE/MBE/DBE utilized by the Testing and Inspection Contractor, Smith Emery:

Blaze Personnel

A.J. Coring

Innovative Solutions

Forest Product Inspection

WBE/MBE/DBE utilized by the Parking Contractor, Walker Parking Consultants:

Kaku Associates

Other WBE/MBE/DBE Contractors:

Firm

Type of Work

Blackman & Hoberton

Relocation Consultant

Environmental Engineering

Contaminated Soil

Fine Arts Services, Inc.

Art Consultant

Gilbert Vasquez

CPA

Iskander Associates

Cost Consultant

Mesa Services

Contaminated Soil

Peopleworks

DBE Consultant

Sheridan Group

Furniture

Sussman/Prejza & Co.

Graphics Consultant

BART/SAN FRANCISCO AIRPORT EXTENSION

BART awarded the Line Contract to Tutor-Saliba/Slattery, a Joint Venture. The following is the Joint Venture team.

Tutor-Saliba/Slattery, JV - Prime Contractor and Facilities Construction

Specialty (professional service) subcontractors

Firm	Type of Work
HNTB Corporation	Civil, Structural, Architectural and Management Services
Thomas K. Dyer, Inc.	Systems Design and Integration Services
PGH Wong Engineering, Inc.	Systems Integration
Automatic Switching and Controls (DBE)	Systems Integration
Foster Engineering, Inc.	Civil, Utilities, Structural
Business Development, Inc. (DBE)	DBE Technical Assistance
Chris Pattillo Associates (DBE)	Landscape Architecture and Irrigation
Transmetrics, Inc.	Utilities, Construction Engineer
YEI Engineers, Inc. (DBE)	Electrical, Mechanical
Geomatrix Consultants, Inc.	Geotechnical
Harding Lawson Associates	Environmental Services
Jiu/Korve Associates (DBE)	Traffic Designs
Manna Consultants (DBE)	Utility and Structure Design
Ajmani and Pamidi, Inc.	Electrical
NBA Engineering (DBE)	Systems Designs

DBE Contractors

The following provides more information on the DBE contractors working on this project:

Firm	Type of Work
Fanfa	Earthwork/Paving/Site Construction
RMT Landscaping	Landscaping
LTM Construction Co.	Formwork/Concrete
KZ Tile	Tile
Vomar Products, Inc.	Station Signage
Brisbane Mechanical Co.	Plumbing
Bleyco Incorporated	Electrical
Michael Willis & Associates	Professional Services
YEI Engineering, Inc.	Professional Services
Merrill-Befu	Landscape Architecture
Business Development, Inc.	DBE Technical Assistance
The Zahm Group	Administrative
Worldwide Land Surveying	Surveying

NEW JERSEY HUDSON-BERGEN LIGHT RAIL

Firm

Twenty-First Century Rail Corporation
KinkiSharyo
Parsons Brinckerhoff Quade & Douglass
Booz-Allen & Hamilton
BEM Systems, Inc.
Contract Compliance, Inc.

Type of Work

Prime Contractor and Facilities Construction
Vehicles
General Design Consultant
Project Management Consultant
Environmental Services Consultant
DBE/WBE/MBE monitoring and compliance

Non-DBE Major Participants subcontracted to Twenty-First Century Rail Corp.

Perini/Slattery A Joint Venture
Railroad Construction Co., Inc.
Dover Elevator, Inc.
KinkiSharyo (USA), Inc.
The Okonite Company
Diadone Electric, Inc.
D'Annunzio & Sons, Inc.
STV, Inc.

Harmon Industries
AFCO Steel
C. Raimondo & Sons Construction Co., Inc.
F&G Mechanical Corp.
J.H. Reid General Contractor
Raytheon Infrastructure Services, Inc.
S.M. Electric, Inc.
Raytheon Engineers

Non-DBE Major Participants subcontracted to Parsons Brinckerhoff

Gannett Fleming Engineering
HNTB Engineering
Litchenstein Engineering

McGuire Associates
Wallace Roberts & Todd Architects
Sverdrup Civil, Inc.

WBE/MBE/DBE Major Participants subcontracted to Booz-Allen & Hamilton, Inc.

Professional Assistance & Consulting, Inc.
Jefferson Co.
Virginkar & Associates
Phillip Habib & Associates

Howard/Stein-Hudson Associates, Inc.
Interactive Elements
W.C. Hannibal
Mundle & Associates

WBE/MBE/DBE Major Participants subcontracted to BEM Systems, Inc.

Jersey Boring & Drilling Co., Inc.
CHEMTECH
Environmental Compliance, Inc.

Matrix Environmental Management, Inc.
Summitt Drilling

WBE/MBE/DBE Firms by Major Project Areas:

Architect/Engineering Professional Services

(DBE Goal 30%)

El Taller Colaborativo
Metro Tech Consultants
Afridi Associates
KS Engineers, P.C.
Medina Consultants
Wagh Associates
J.J. Hwang Engineering

BET Consultants
YU & Associates
Jambhelcar Strauss
Basilio-Avadhani
Dacco Science, Inc.
Garden State Surveying
Grace Graupe-Pillard, Artist

Other Professional Services

(DBE Goal 20%)

LKG-CMC
Amercom Corp.
McClymont Rak
Polytran Engineering
Mega Engineering
Macdel Engineering
Massand Engineering
HSM Software Computer Co.
InfraTech Associates
Herbert G. McDonald Associates
L.E. CADD Corp.
Dishu Associates
Promatech
Maitra & Associates
Ben Thompson Associates
Forrest Associates, Ltd.
Turn-around Appraisals
Joan H. Geismar, PhD.
QWIC, Inc.
John Milligan, CPA
Lynn Drobbin
Adriana Zanotti, Ent.
QEM Enterprises
Interactive Elements

National Reprographics
A. Estaban & Co.
B. Signs and Graphics
Ebony Office Products
George's Exxon
Akian Autoworks
Document Management
WS Exterminating
Professional Pest Control
JMS Company, Inc.
Arrington Dixon & Associates
Controlled Quality Corp. (LOI)
G-Neil
JM Stokes, Inc.
Blueboy Blue Printing
Network Personnel
Promatch, Inc.
Amy Green Environmental Consulting
Matrix Environmental Management
Kenneth Lloyd Gardner
Scharf-Godfrey
Eng-Wong Taub & Associates
Sir Speedy Printing

Facilities Construction

(DBE Goal 30%)

Northeast Construction, Inc.
LWS (LOI)
A&A Industrial Piping
Infinity Development Corp.
Power Concrete, Co.

Adarns Electric Sales
Archer Steel
Sissco/Permadr (LOI)
Josloff Industries
CSR Construction

Heavy Civil Construction

(DBE Goal 15%)

Pile Mechanics, Inc.
American Indian Builders
MDS Environmental Services
Vibranalysis
Valcon Constructing Services
Secure-It-Fastener
Parsippany Construction
Quick-Wright
MS Pipe Hangers (Steel)
Adams Electric
Consolidated Steel & Aluminum
Loni Contracting, Inc.
Applied Landscape Technologies, Inc.

William G. Moore & Sons
Northeast Construction, Inc.
W. Kelly Equipment, Inc.
Archer Steel Construction
Berto Construction
Aponte Construction
Marner Bros. Construction
S&T Trucking
National Fence
Kevco Electric
Interstate Wrecking
Evergreen Electric
Carter Bros., Inc.

